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(54) **SHIP**

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CPC ***B63H 25/46*** (2013.01); ***B63H 21/21*** (2013.01); *B63H 2021/216* (2013.01); *B63H 2025/465* (2013.01)

(57) **ABSTRACT**

A ship including an engine, a jet propulsion device, a ship controller, and a ship position detection unit, in which the jet propulsion device includes a nozzle that ejects a jet stream generated by the driving force output from the engine, and a bucket that changes a direction of the jet stream, the position of the bucket includes at least a forward-side intermediate position between the forward position and the neutral position, the ship controller has a ship fixed point holding mode in which feedback control of the engine and the jet propulsion device is performed based on a deviation between a preset target ship position and the actual ship position, and both control of the position of the bucket including the forward-side intermediate position and control of a rotational speed of the engine are performed in the ship fixed point holding mode.

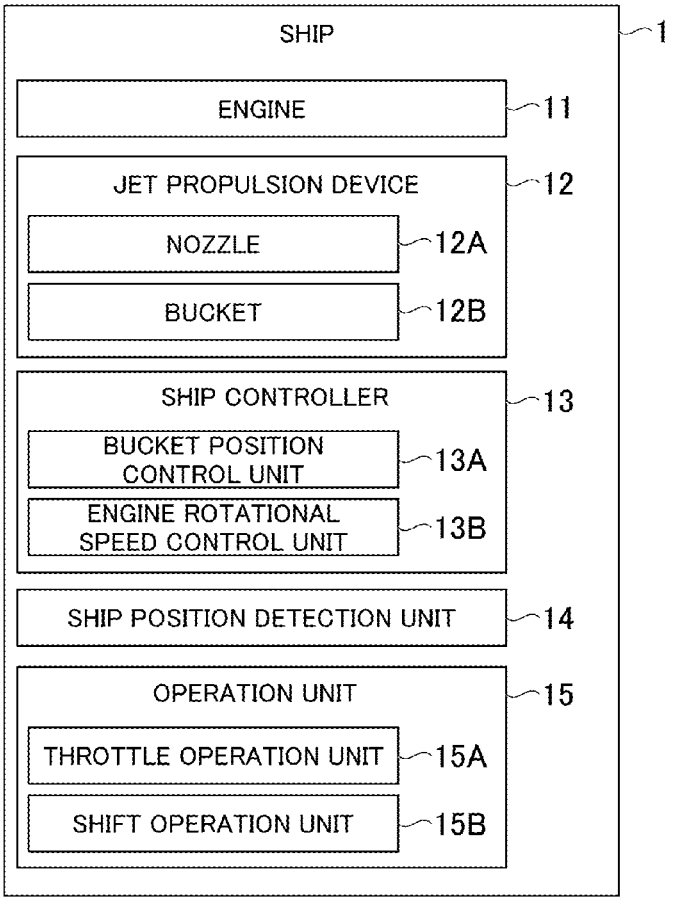


FIG. 1

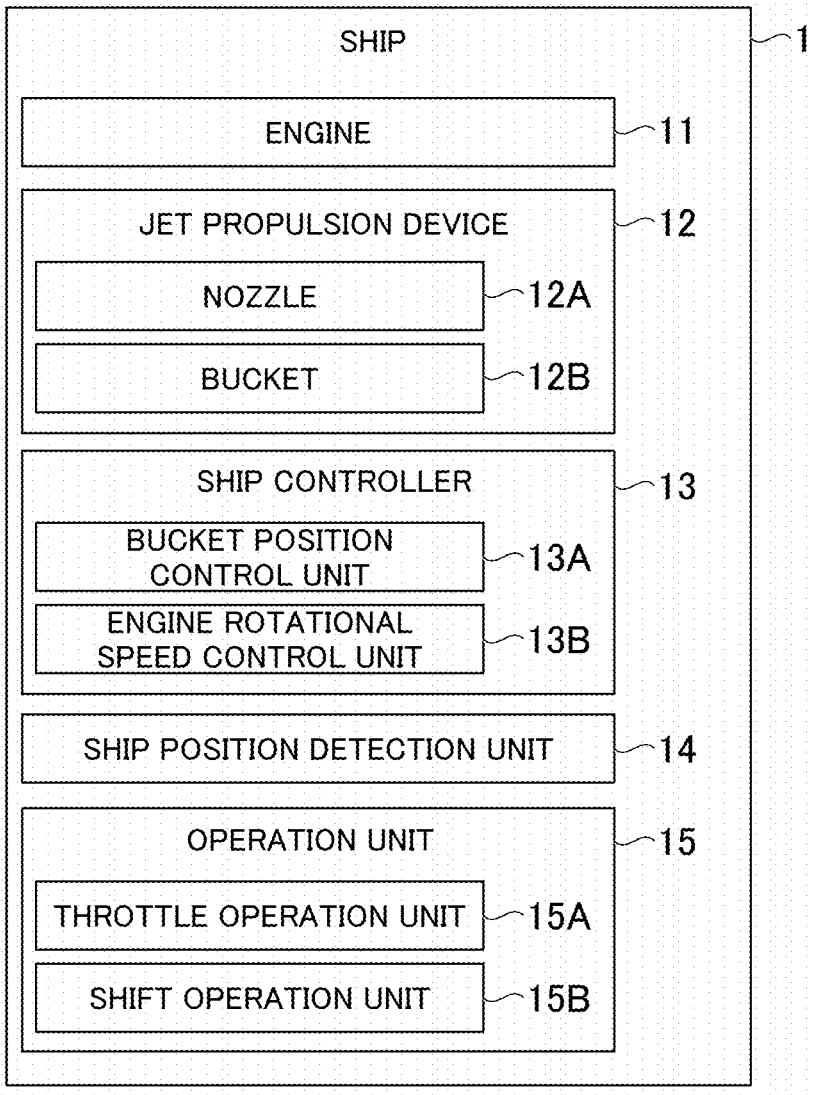

SHIP
1
ENGINE
11
JET PROPULSION DEVICE
12
NOZZLE
12A
BUCKET
12B
SHIP CONTROLLER
13
BUCKET POSITION CONTROL UNIT
13A
ENGINE ROTATIONAL SPEED CONTROL UNIT
13B
SHIP POSITION DETECTION UNIT
14
OPERATION UNIT
15
THROTTLE OPERATION UNIT
15A
SHIFT OPERATION UNIT
15B

FIG. 2A

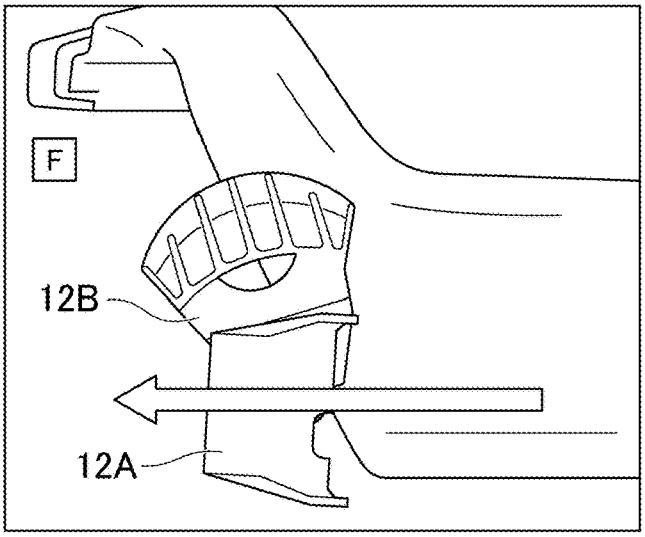


FIG. 2B

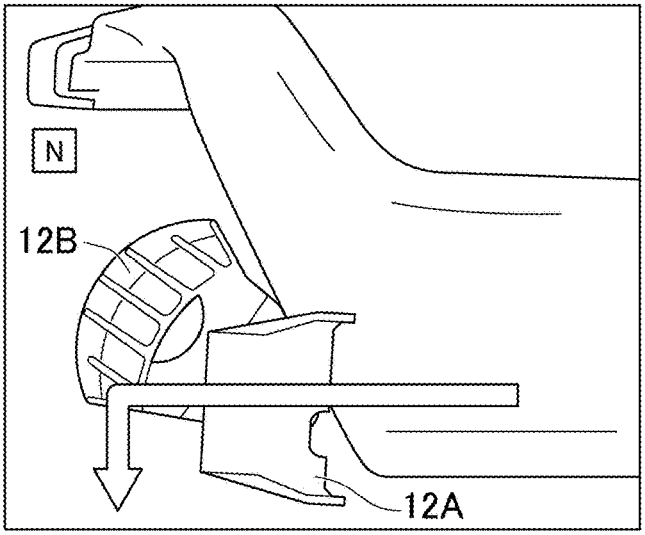


FIG. 2C

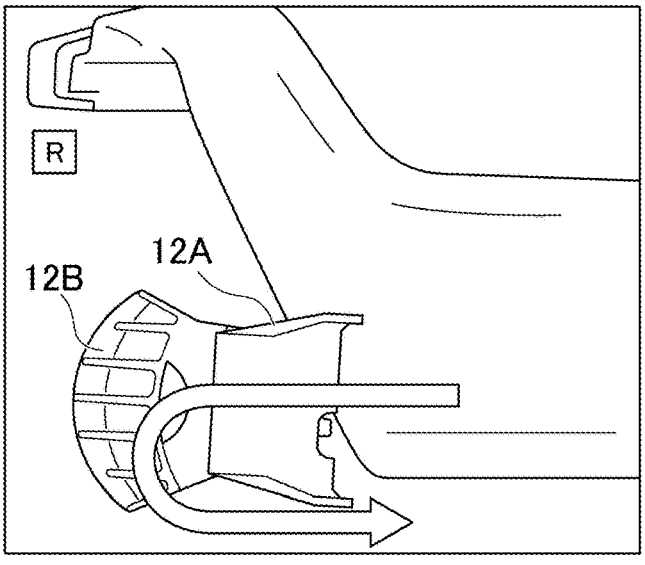


FIG. 3

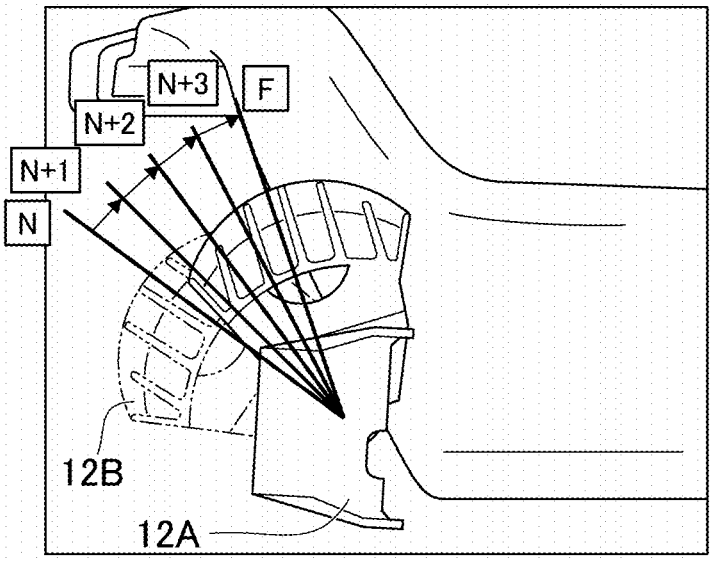

N+3
F
N+2
N+1
N
12B
12A

FIG. 4

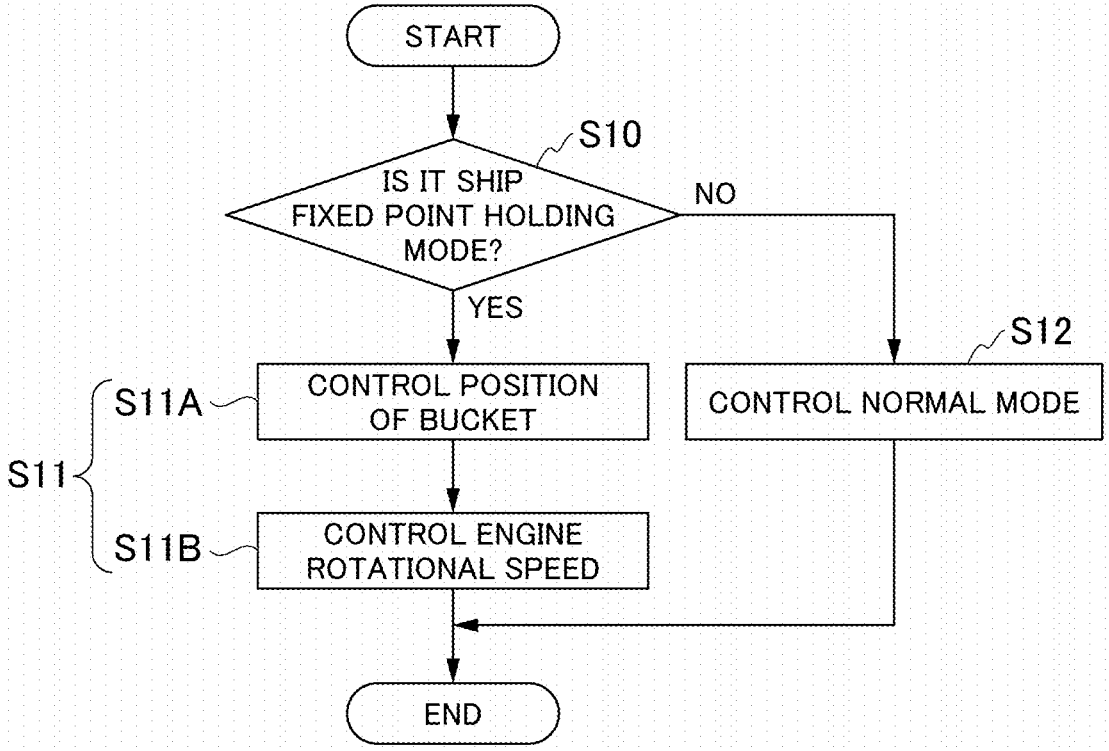

START
S10
IS IT SHIP FIXED POINT HOLDING MODE?
NO
YES
S12
CONTROL NORMAL MODE
S11
S11A
CONTROL POSITION OF BUCKET
S11B
CONTROL ENGINE ROTATIONAL SPEED
END

FIG. 5

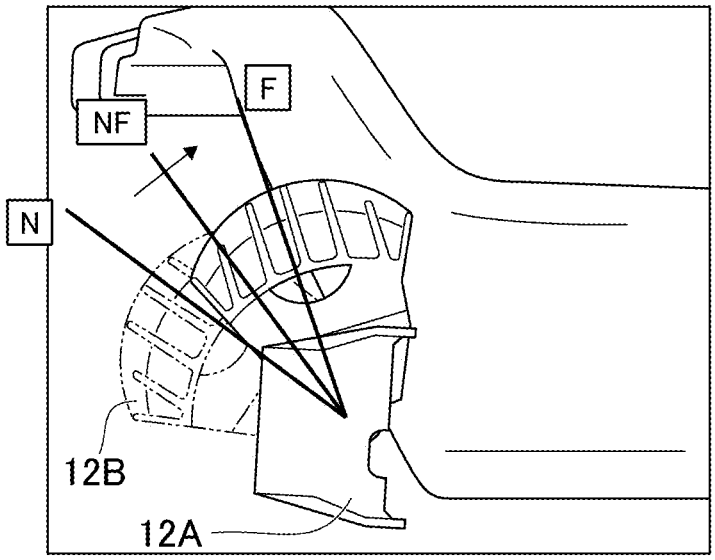


FIG. 6

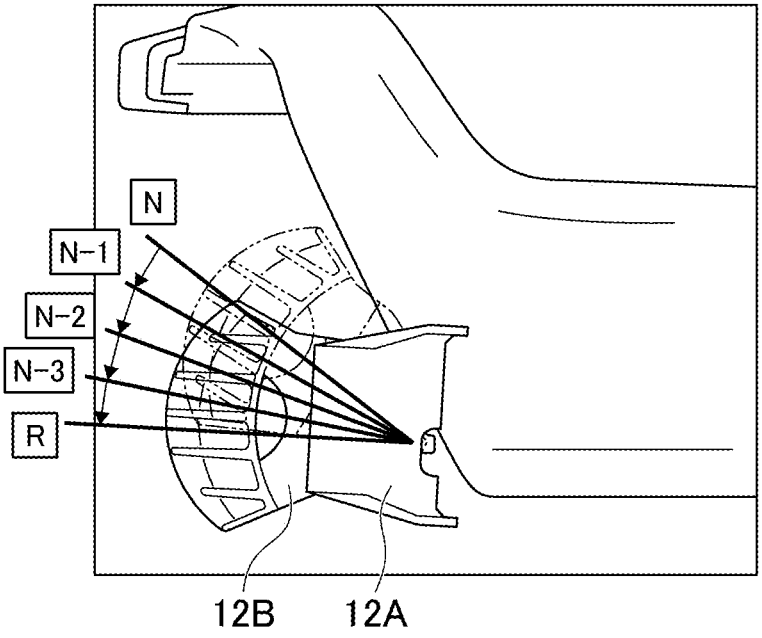


FIG. 7

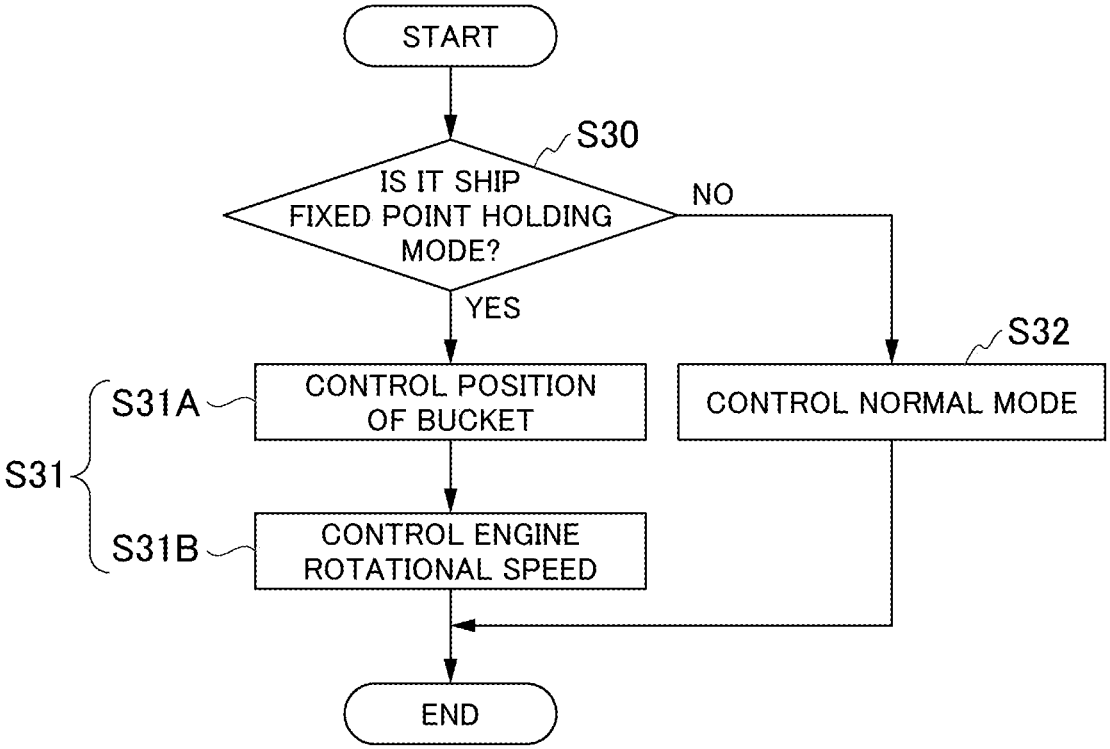

START
S30
IS IT SHIP FIXED POINT HOLDING MODE?
NO
YES
S32
CONTROL NORMAL MODE
S31
S31A
CONTROL POSITION OF BUCKET
S31B
CONTROL ENGINE ROTATIONAL SPEED
END

FIG. 8

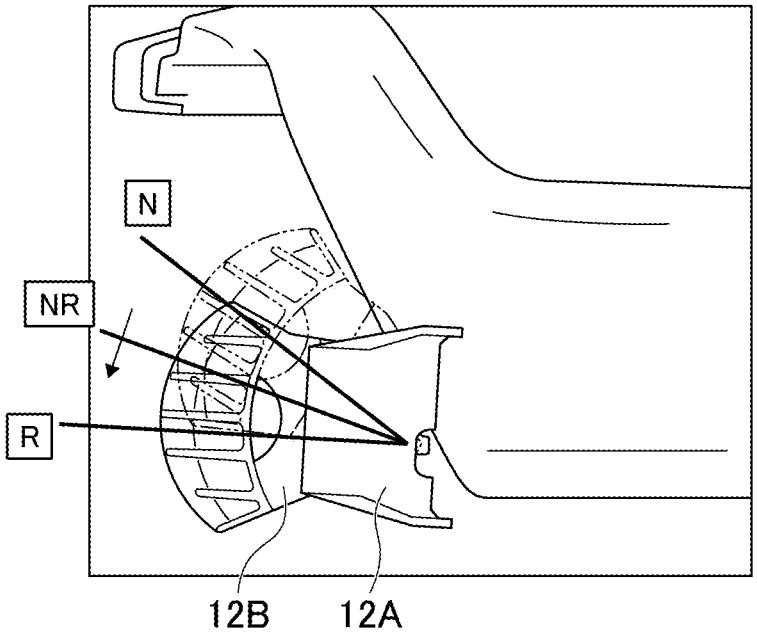

N
NR
R
12B
12A

FIG. 9

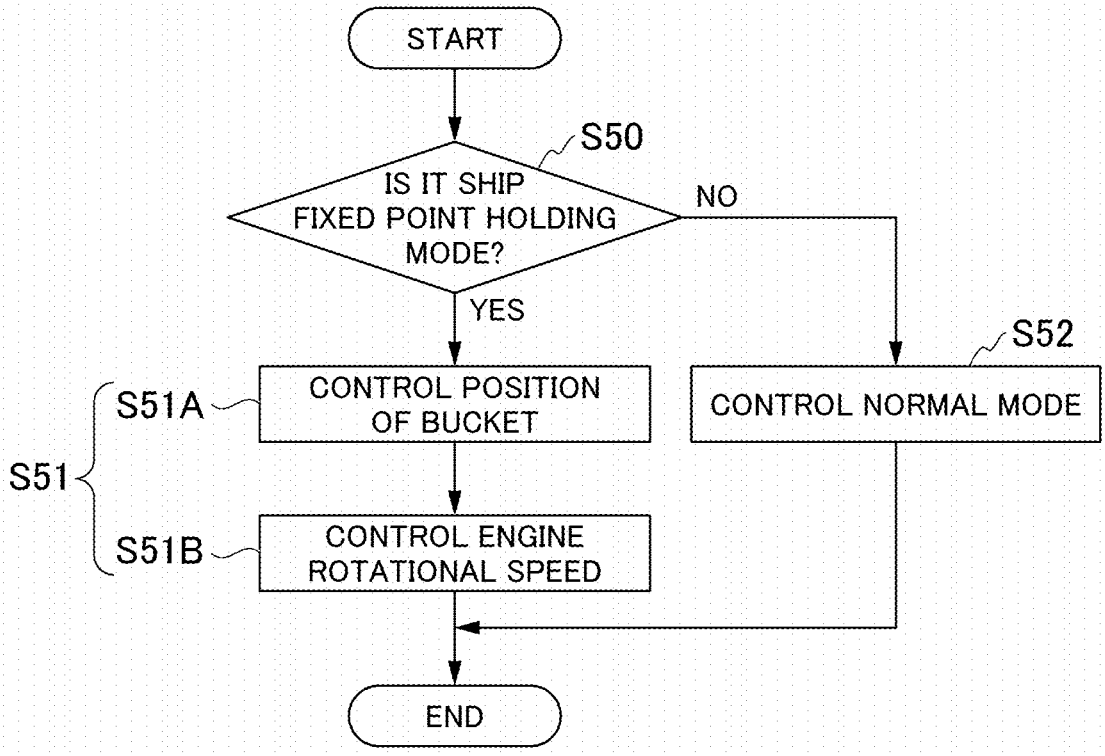

START
S50
IS IT SHIP FIXED POINT HOLDING MODE?
NO
YES
S52
CONTROL NORMAL MODE
S51
S51A
CONTROL POSITION OF BUCKET
S51B
CONTROL ENGINE ROTATIONAL SPEED
END

FIG. 10A

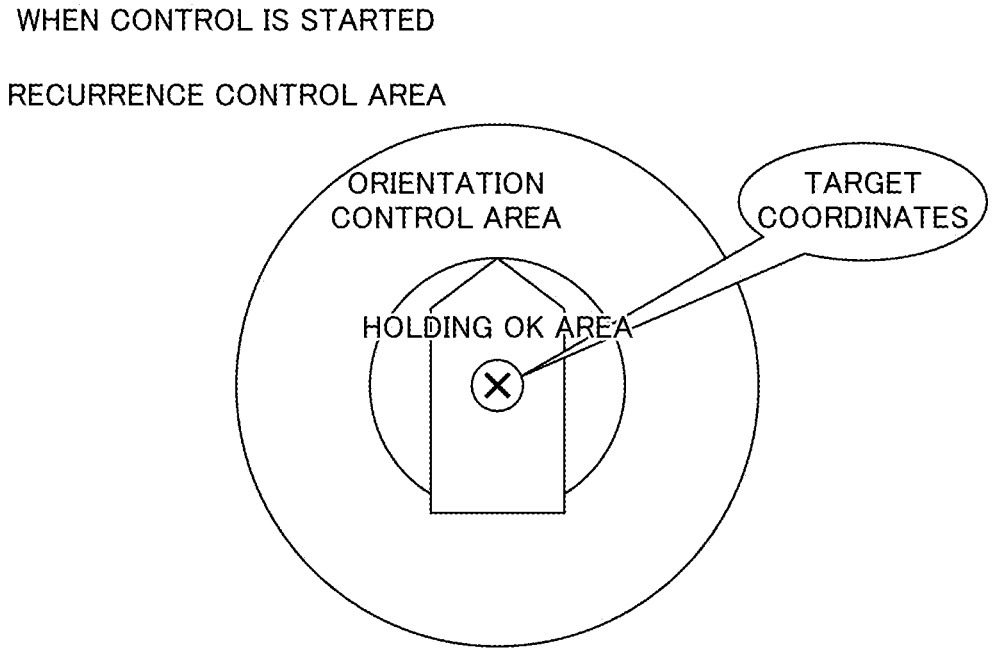


FIG. 10B

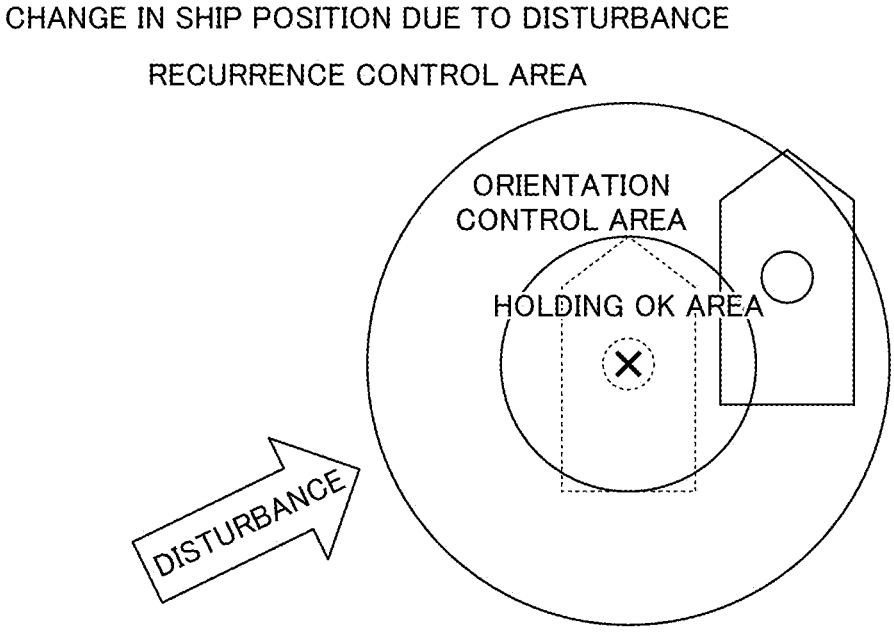


FIG. 11A

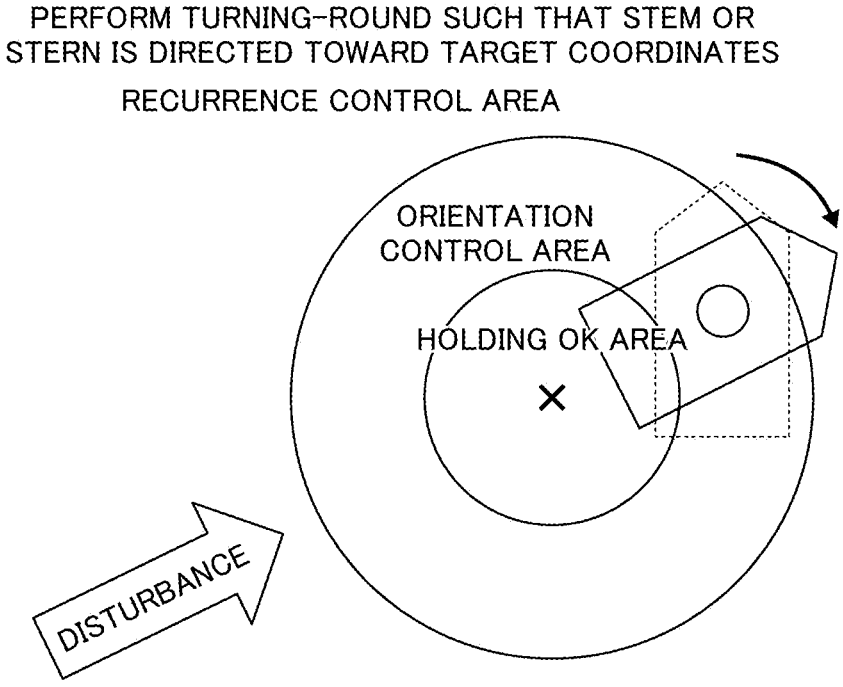


FIG. 11B

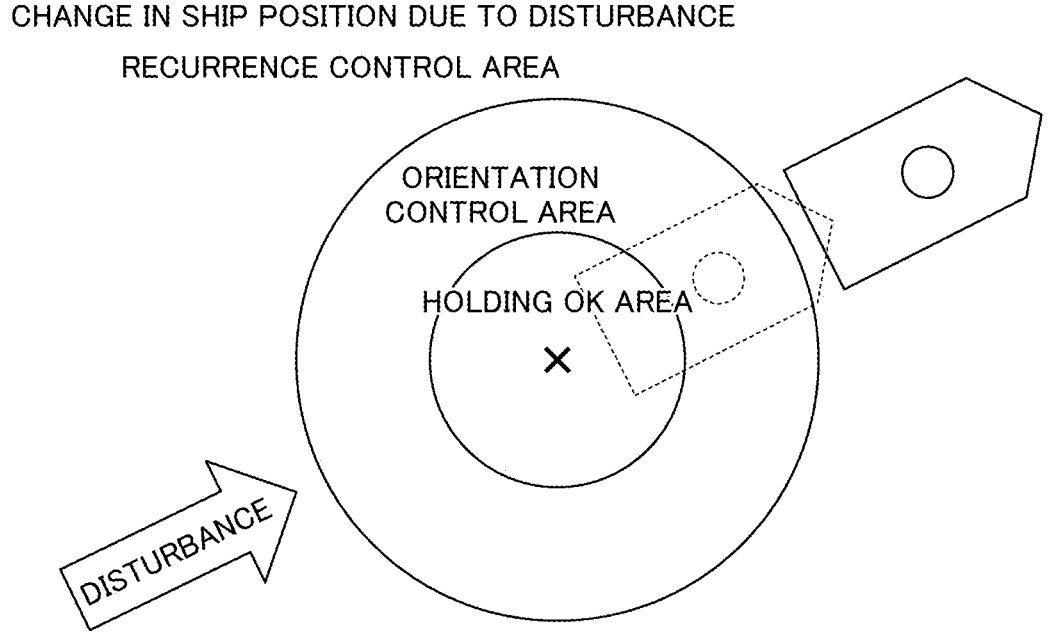


FIG. 12

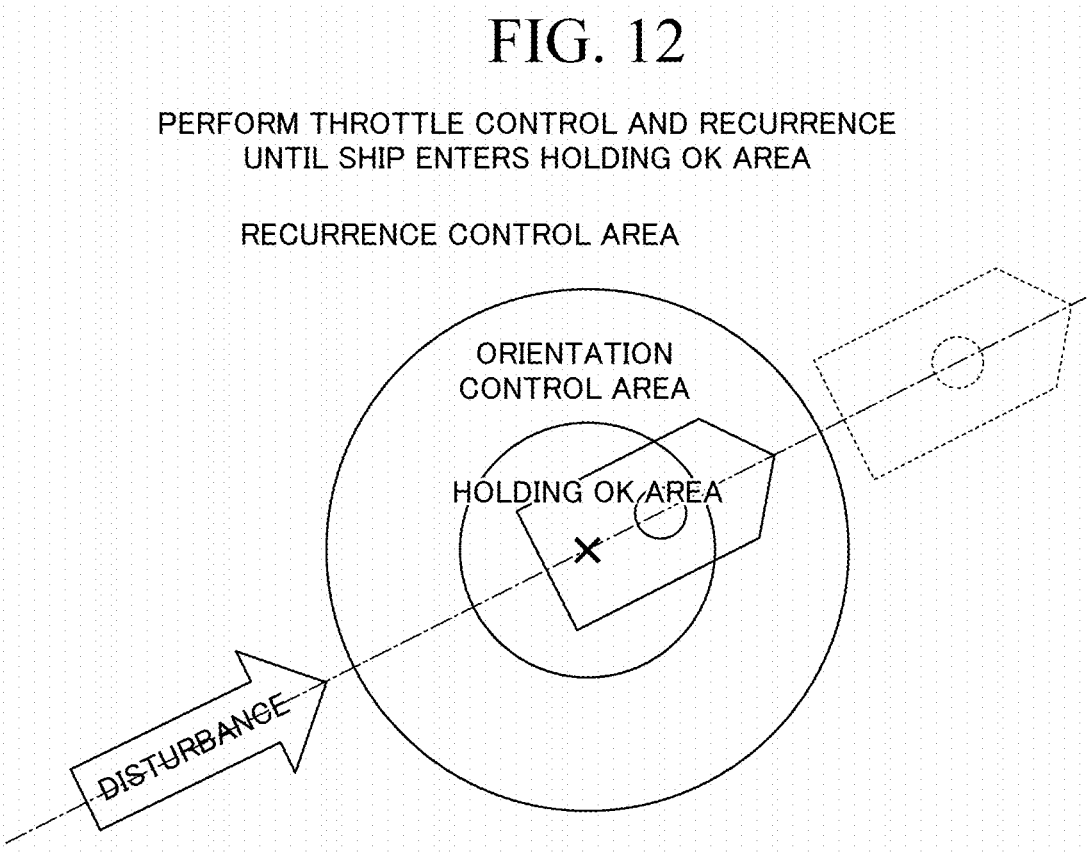

PERFORM THROTTLE CONTROL AND RECURRENCE
UNTIL SHIP ENTERS HOLDING OK AREA
RECURRENCE CONTROL AREA
ORIENTATION
CONTROL AREA
HOLDING OK AREA
DISTURBANCE

FIG. 13A

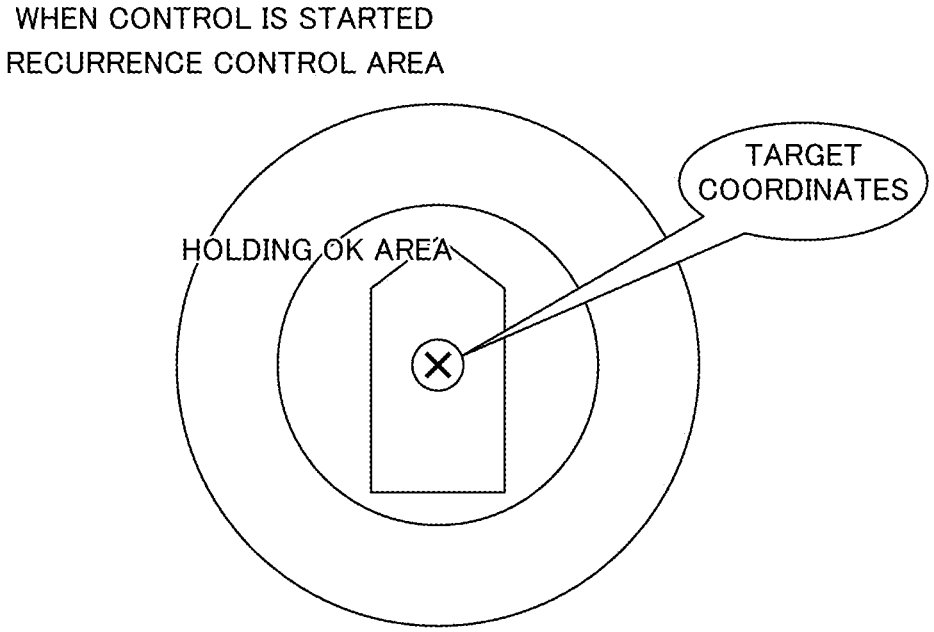


FIG. 13B

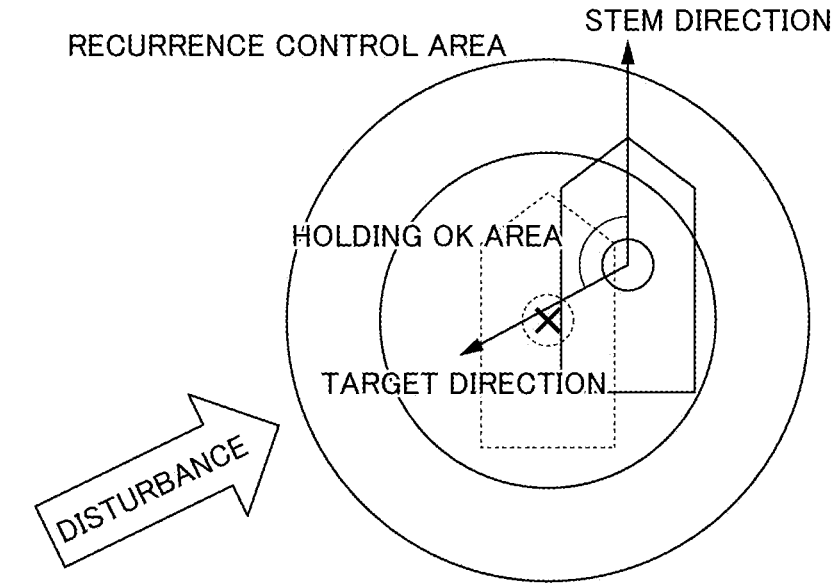


FIG. 14A

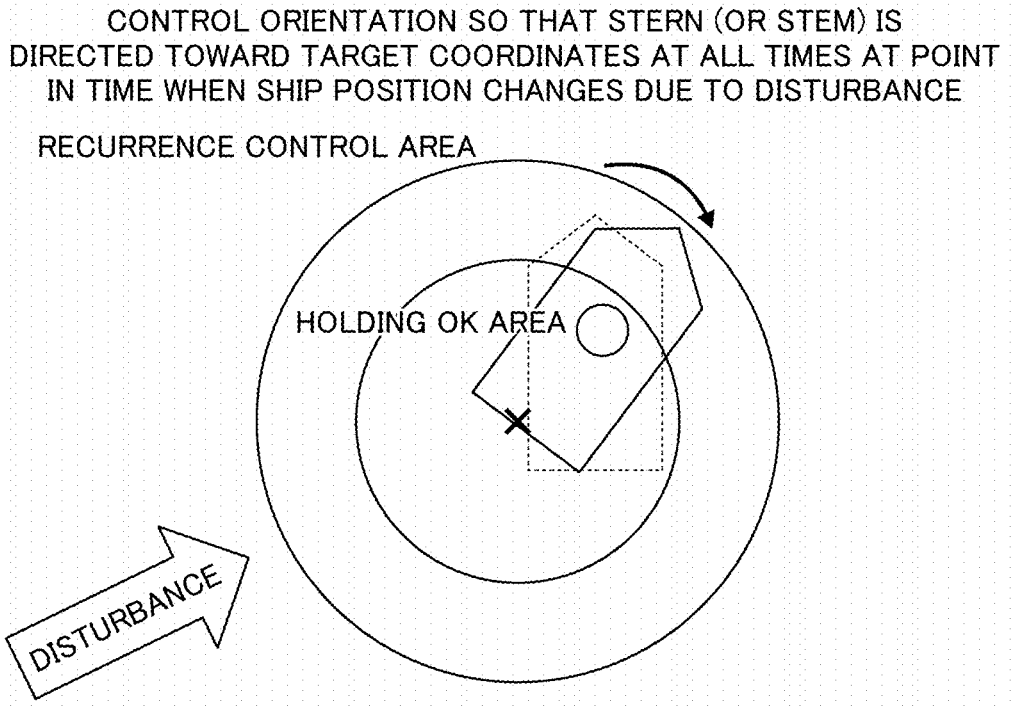


FIG. 14B

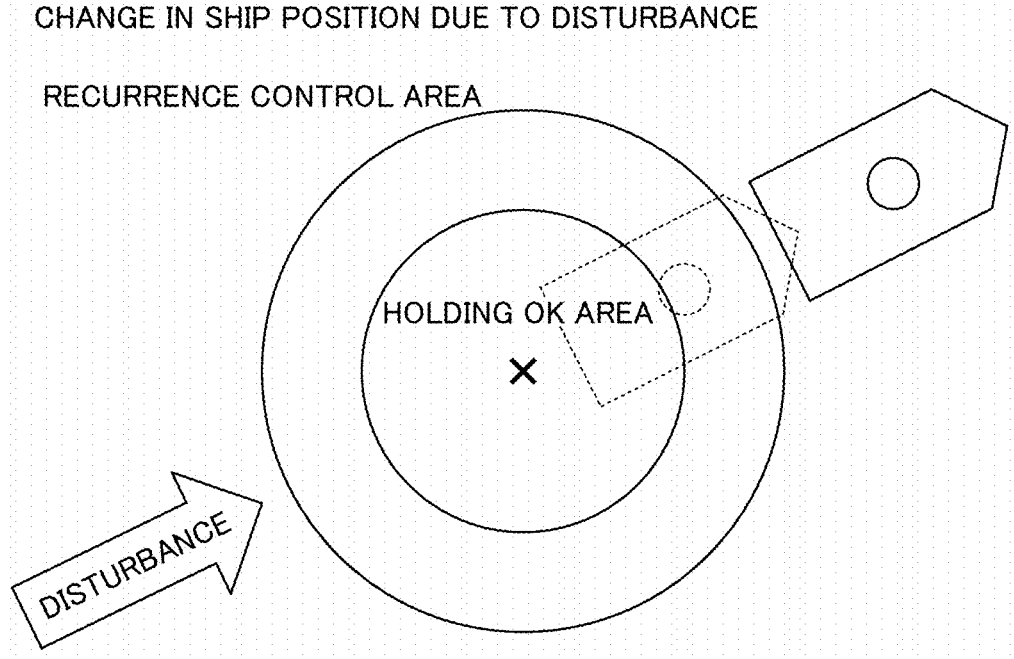
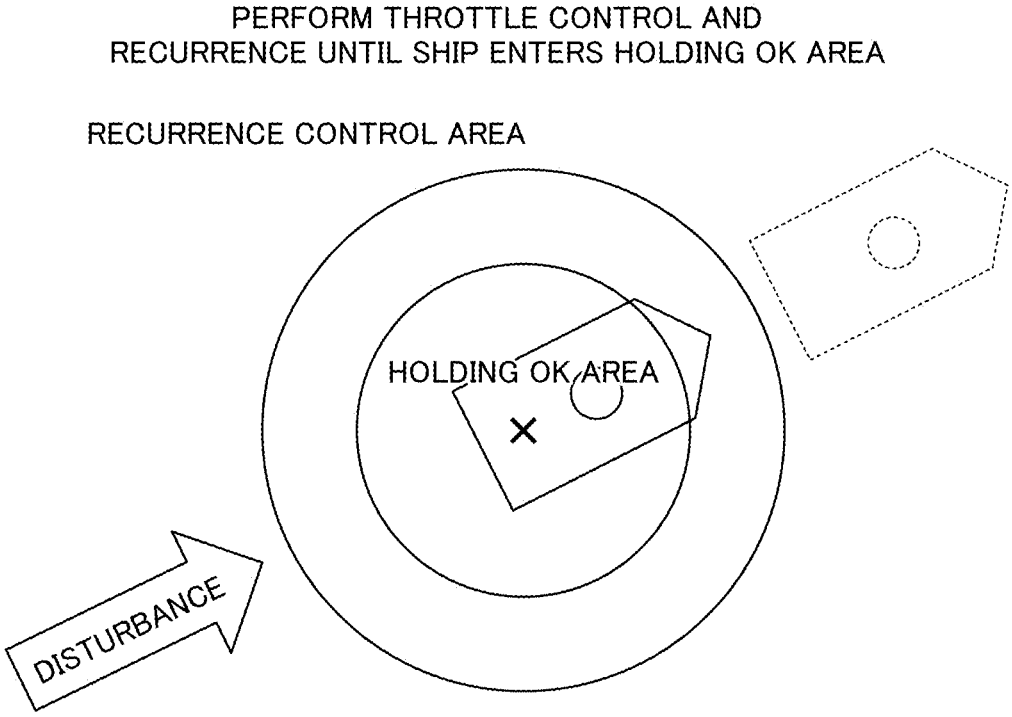


FIG. 15


PERFORM THROTTLE CONTROL AND
RECURRENCE UNTIL SHIP ENTERS HOLDING OK AREA
RECURRENCE CONTROL AREA
HOLDING OK AREA
DISTURBANCE

SHIP

CROSS REFERENCE TO PRIOR APPLICATIONS

[0001] This application is a continuation under 35 U.S.C. § 120 of PCT/JP2022/025713, filed Jun. 28, 2022, which is incorporated herein by reference, and which claimed priority to Japanese Application No. 2021-106920, filed Jun. 28, 2021. The present application likewise claims priority under 35 U.S.C. § 119 to Japanese Application No. 2021-106920, filed Jun. 28, 2021, the entire content of which is also incorporated herein by reference.

TECHNICAL FIELD

[0002] The present invention relates to a ship.

BACKGROUND ART

[0003] Hitherto, a small ship having jet propulsion devices has become known (see, for example, Patent Literature 1). The small ship disclosed in Patent Literature 1 is conured such that a bucket is switchable between a raised position (forward position) and a lowered position (reverse position). When the bucket is disposed at the raised position, the small ship heads forward because a water jet ejected from a nozzle heads toward the rear of the ship without hitting the bucket. When the bucket is disposed at the lowered position, the small ship heads backward because a water jet ejected from the nozzle hits the bucket and heads toward the front of the ship.

[0004] Incidentally, Patent Literature 1 does not disclose control of ship fixed point holding. For this reason, it is not possible to appropriately control ship fixed point holding by the technique disclosed in Patent Literature 1.

[0005] Hitherto, a jet propulsion ship that moves forward by ejecting a jet backward from a jet propulsion mechanism has become known (see, for example, Patent Literature 2). The jet propulsion ship disclosed in Patent Literature 2 includes a bucket that changes the direction of a jet from the jet propulsion mechanism. The bucket is movable between a forward position and an operating position, and the forward position is a position where the bucket is retracted from an injection port of a jet. The operating position is a position where the bucket faces the injection port of the jet. In the jet propulsion ship disclosed in Patent Literature 2, the jet propulsion ship is moved backward by disposing the bucket at a first operating position (reverse position).

[0006] Patent Literature 2 discloses that the jet propulsion ship is held at a fixed position by disposing the bucket at a second operating position (neutral position).

[0007] Incidentally, in an environment where there are disturbances (for example, wind, a tidal current, and the like), such as at sea, it is not possible to hold a jet propulsion ship at a fixed position (at a fixed point) by simply disposing a bucket at a neutral position, as disclosed in Patent Literature 2.

CITATION LIST

[0008] Patent Document Patent Document 1

[0009] Japanese Unexamined Patent Application, First Publication No. 2003-237693 Patent Document 2

[0010] Japanese Unexamined Patent Application, First Publication No. 2014-073790

SUMMARY OF INVENTION

Technical Problem

[0011] The inventors of the present invention have conducted intensive research and found that it is possible to perform control of ship fixed point holding with high accuracy even in an environment where disturbances occur by performing control of disposing a bucket at an intermediate position between a forward position and a neutral position, or at an intermediate position between a reverse position and the neutral position, and control of a rotational speed of an engine that outputs a driving force generating a jet stream.

[0012] That is, an object of the present invention is to provide a ship which are capable of improving controllability of ship fixed point holding.

Solution to Problem

[0013] An aspect of the present invention is a ship including an engine that outputs a driving force, a jet propulsion device that generates a propulsion force of the ship using the driving force output from the engine, a ship controller that controls the engine and the jet propulsion device, and a ship position detection unit that detects an actual ship position which is an actual position of the ship, in which the jet propulsion device includes a nozzle that ejects a jet stream generated by the driving force output from the engine, and a bucket that changes a direction of the jet stream ejected from the nozzle, the position of the bucket includes at least a forward position where the jet propulsion device generates a propulsive force for moving the ship forward, a neutral position where the jet propulsion device does not generate a propulsive force for moving the ship, and a forward-side intermediate position between the forward position and the neutral position, the ship controller has a ship fixed point holding mode in which feedback control of the engine and the jet propulsion device is performed based on a deviation between a target ship position, which is a preset target position of the ship, and the actual ship position, and both control of the position of the bucket including the forward-side intermediate position and control of a rotational speed of the engine are performed in the ship fixed point holding mode.

[0014] An aspect of the present invention is a ship including an engine that outputs a driving force, a jet propulsion device that generates a propulsion force of the ship using the driving force output from the engine, a ship controller that controls the engine and the jet propulsion device, and a ship position detection unit that detects an actual ship position which is an actual position of the ship, in which the jet propulsion device includes a nozzle that ejects a jet stream generated by the driving force output from the engine, and a bucket that changes a direction of the jet stream ejected from the nozzle, the position of the bucket includes at least a forward position where the jet propulsion device generates a propulsive force for moving the ship forward, a neutral position where the jet propulsion device does not generate a propulsive force for moving the ship, a reverse position where the jet propulsion device generates a propulsive force for moving the ship backward, and a reverse-side intermediate position between the reverse position and the neutral position, the ship controller has a ship fixed point holding mode in which feedback control of the engine and the jet

propulsion device is performed based on a deviation between a target ship position, which is a preset target position of the ship, and the actual ship position, and both control of the position of the bucket including the reverse-side intermediate position and control of a rotational speed of the engine are performed in the ship fixed point holding mode.

[0015] An aspect of the present invention is a ship including an engine that outputs a driving force, a jet propulsion device that generates a propulsion force of the ship using the driving force output from the engine, a ship controller that controls the engine and the jet propulsion device, and a ship position detection unit that detects an actual ship position which is an actual position of the ship, in which the jet propulsion device includes a nozzle that ejects a jet stream generated by the driving force output from the engine, and a bucket that changes a direction of the jet stream ejected from the nozzle, the position of the bucket includes at least a forward position where the jet propulsion device generates a propulsive force for moving the ship forward, a neutral position where the jet propulsion device does not generate a propulsive force for moving the ship, a reverse position where the jet propulsion device generates a propulsive force for moving the ship backward, a forward-side intermediate position between the forward position and the neutral position, and a reverse-side intermediate position between the reverse position and the neutral position, the ship controller has a ship fixed point holding mode in which feedback control of the engine and the jet propulsion device is performed based on a deviation between a target ship position, which is a preset target position of the ship, and the actual ship position, and both control of the position of the bucket including the forward-side intermediate position and the reverse-side intermediate position and control of a rotational speed of the engine are performed in the ship fixed point holding mode.

Advantageous Effects of Invention

[0016] According to the present invention, it is possible to provide a ship, a ship controller, a ship control method and a non-transitory computer readable medium which are capable of improving controllability of holding a ship at a fixed point.

BRIEF DESCRIPTION OF DRAWINGS

[0017] FIG. **1** is a diagram showing an example of a ship according to a first embodiment.

[0018] FIG. **2**A is a diagram showing an example of configurations of a nozzle and a bucket.

[0019] FIG. **2**B is a diagram showing an example of configurations of a nozzle and a bucket.

[0020] FIG. **2**C is a diagram showing an example of configurations of a nozzle and a bucket.

[0021] FIG. **3** is a diagram showing an example of the position of the bucket controlled by a bucket position control unit of a ship controller when a ship controller is in a ship fixed point holding mode.

[0022] FIG. **4** is a flowchart showing an example of processing performed by the ship controller of the ship according to the first embodiment.

[0023] FIG. **5** is a diagram showing the position of a bucket controlled by a bucket position control unit of a ship controller when the ship controller of a ship according to a second embodiment is in a ship fixed point holding mode.

[0024] FIG. **6** is a diagram showing an example of the position of a bucket controlled by a bucket position control unit of a ship controller when the ship controller of a ship according to a third embodiment is in a ship fixed point holding mode.

[0025] FIG. **7** is a flowchart showing an example of processing performed by the ship controller of the ship according to the third embodiment.

[0026] FIG. **8** is a diagram showing the position of a bucket controlled by a bucket position control unit of a ship controller when the ship controller of a ship according to a fourth embodiment is in a ship fixed point holding mode.

[0027] FIG. **9** is a flowchart showing an example of processing performed by a ship controller of a ship according to a fifth embodiment.

[0028] FIG. **10**A is a diagram showing an example of control that can be performed in the ships according to the first to seventh embodiments.

[0029] FIG. **10**B is a diagram showing an example of control that can be performed in the ships according to the first to seventh embodiments.

[0030] FIG. **11**A is a diagram showing an example of control that can be performed in the ships according to the first to seventh embodiments.

[0031] FIG. **11**B is a diagram showing an example of control that can be performed in the ships according to the first to seventh embodiments.

[0032] FIG. **12** is a diagram showing an example of control that can be performed in the ships according to the first to seventh embodiments.

[0033] FIG. **13**A is a diagram showing another example of control that can be executed in the ships according to the first to seventh embodiments.

[0034] FIG. **13**B is a diagram showing another example of control that can be executed in the ships according to the first to seventh embodiments.

[0035] FIG. **14**A is a diagram showing another example of control that can be executed in the ships according to the first to seventh embodiments.

[0036] FIG. **14**B is a diagram showing another example of control that can be executed in the ships according to the first to seventh embodiments.

[0037] FIG. **15** is a diagram showing another example of control that can be executed in the ships according to the first to seventh embodiments.

DESCRIPTION OF EMBODIMENTS

First Embodiment

[0038] Hereinafter, a first embodiment of a ship, a ship controller, a ship control method and a non-transitory computer readable medium of the present invention will be described.

[0039] FIG. **1** is a diagram showing an example of a ship **1** according to the first embodiment.

[0040] In the example shown in FIG. **1**, the ship **1** according to the first embodiment is a PWC having the same basic functions as a personal watercraft (PWC) described with reference to FIG. 1 of Patent Document 1 or Patent Document 2, for example. The ship **1** includes, for example, an engine **11**, a jet propulsion device **12**, a ship controller **13**, a ship position detection unit **14**, and an operation unit **15**.

[0041] The engine **11** outputs a driving force. The jet propulsion device **12** generates a propulsive force for the ship **1** using the driving force output from the engine **11**. The jet propulsion device **12** includes a nozzle **12**A and a bucket **12**B. The nozzle **12**A ejects a jet stream generated by the driving force output from the engine **11**. The bucket **12**B changes the direction of the jet stream ejected from the nozzle **12**A.

[0042] FIG. **2**A to FIG. **2**C are diagrams showing examples of configurations of the nozzle **12**A and the bucket **12**B. In detail, FIGS. **2**A to **2**C are diagrams showing examples of a basic position of the bucket **12**B. Specifically, FIG. **2**A shows a positional relationship between the nozzle **12**A and the bucket **12**B and a jet stream when the bucket **12**B is disposed at a forward position F. FIG. **2**B shows a positional relationship between the nozzle **12**A and the bucket **12**B and a jet stream when the bucket **12**B is disposed at a neutral position N. FIG. **2**C shows a positional relationship between the nozzle **12**A and the bucket **12**B and a jet stream when the bucket **12**B is disposed at a reverse position R.

[0043] As shown in FIG. **2**A, in a state where the bucket **12**B is disposed at the forward position F, a jet stream ejected from the nozzle **12**A does not hit the bucket **12**B. That is, the direction of the jet stream ejected from the nozzle **12**A is not changed by the bucket **12**B. As a result, in a state where the bucket **12**B is disposed at the forward position F, the jet propulsion device **12** generates a propulsive force for moves the ship **1** forward (that is, a propulsive force for moving the ship **1** rightward in FIG. **2**A).

[0044] As shown in FIG. **2**B in a state where the bucket **12**B is disposed at the neutral position N, a part of the jet stream ejected from the nozzle **12**A hits the bucket **12**B, and the remaining part of the jet stream ejected from the nozzle **12**A does not hit the bucket **12**B. For this reason, in a state where the bucket **12**B is disposed at the neutral position N, the jet stream ejected from the nozzle **12**A is represented by an arrow in FIG. **2**B. As a result, in a state where the bucket **12**B is disposed at the neutral position N, the jet propulsion device **12** does not generate a propulsive force for moving the ship **1**.

[0045] As shown in FIG. **2**C, in a state where the bucket **12**B is disposed at the reverse position R, the entire jet stream ejected from the nozzle **12**A hits the bucket **12**B. That is, the direction of the jet stream ejected from the nozzle **12**A is changed to the right in FIG. **2**C by the bucket **12**B. As a result, in a state where the bucket **12**B is disposed at the reverse position R, the jet propulsion device **12** generates a propulsive force for moving the ship **1** backward (that is, a propulsive force for moving the ship **1** to the left in FIG. **2**C).

[0046] In the example shown in FIG. **2**A, FIG. **2**B or FIG. **2**C, the bucket **12**B is configured to be rotatable around a rotation center axis extending in a horizontal direction (a direction from the front side to the back side in FIG. **2**A, FIG. **2**B or FIG. **2**C). However, in another examples, the bucket **12**B may be configured to be rotatable around a rotation center axis extending in a vertical direction (the up-down direction in FIG. **2**A, FIG. **2**B or FIG. **2**C). In detail, as disclosed in, for example, Japanese Patent No. 3971161, the bucket **12**B may be constituted by two members, and the two members may be configured to open right and left.

[0047] In the example shown in FIG. **1**, the ship controller **13** performs control of the engine **11** and the jet propulsion device **12**, and the like. The ship controller **13** includes, for example, a bucket position control unit **13**A and an engine rotational speed control unit **13**B.

[0048] The bucket position control unit **13**A controls the position of the bucket **12**B (for example, control of disposing the bucket **12**B at the forward position F, control of disposing the bucket **12**B at the neutral position N, control of disposing the bucket **12**B at the reverse position R, and the like).

[0049] The engine rotational speed control unit **13**B controls the rotational speed of the engine **11** (that is, control of changing the strength of the jet stream shown in FIG. **2**A, FIG. **2**B or FIG. **2**C).

[0050] The ship position detection unit **14** detects an actual ship position, which is the actual position of the ship **1**. The ship position detection unit **14** includes, for example, a global positioning system (GPS) device. The GPS device calculates the position coordinates of the ship **1** by receiving signals from a plurality of GPS satellites.

[0051] The operation unit **15** receives input operations from a ship operator. The operation unit **15** includes a throttle operation unit **15**A and a shift operation unit **15**B. The throttle operation unit **15**A is configured in the same manner as, for example, a throttle operation unit disclosed in Patent Document 2, and receives input operations from the ship operator to adjust the rotational speed of the engine **11**. The shift operation unit **15**B is configured in the same manner as, for example, a shift operation unit disclosed in Patent Document 2, and receives input operations from the ship operator to switch the position of the bucket **12**B between the forward position F, the neutral position N, and the reverse position R.

[0052] In a normal mode of the ship controller **13**, the bucket position control unit **13**A controls the position of the bucket **12**B to any of the forward position F, the neutral position N, and the reverse position R based on an input operation received from the ship operator by the shift operation unit **15**B. In the normal mode of the ship controller **13**, the engine rotational speed control unit **13**B controls the rotational speed of the engine **11** (control of changing the strength of the jet stream shown in FIG. **2**A, FIG. **2**B or FIG. **2**C) based on an input operation received from the ship operator by the throttle operation unit **15**A.

[0053] In the example shown in FIG. **1**, the ship controller **13** not only has the above-mentioned normal mode but also has a ship fixed point holding mode. In the ship fixed point holding mode of the ship controller **13**, the ship controller **13** performs feedback control (for example, PID control and the like) of the engine **11** and the jet propulsion device **12** based on a deviation between a target ship position, which is a preset target position of the ship **1**, and the actual ship position.

[0054] The target ship position is set in advance in accordance with, for example, an input operation of the ship operator (for example, an input operation in which the ship operator turns on a switch (not shown) when the ship **1** is located at a desired position).

[0055] In another example, the target ship position may be set in advance, for example, by the ship operator inputting numerical values of the coordinates of a desired position of the ship **1**.

[0056] FIG. **3** is a diagram showing an example of the position of the bucket **12**B controlled by the bucket position

control unit **13**A of the ship controller **13** when the ship controller **13** is in a ship fixed point holding mode.

[0057] In the example shown in FIG. **3**, when the ship controller **13** is in the ship fixed point holding mode, a neutral position N, a forward position F, and three forward-side intermediate positions N+1, N+2, and N+3 located therebetween are set as the position of the bucket **12**B that can be disposed by the bucket position control unit **13**A of the ship controller **13**.

[0058] That is, the position of the bucket **12**B that can be disposed by the bucket position control unit **13**A in the ship fixed point holding mode of the ship controller **13** includes the neutral position N, the forward-side intermediate position N+1, the forward-side intermediate position N+2, the forward-side intermediate position N+3, and the forward position F.

[0059] In the example shown in FIG. **3**, the three forward-side intermediate positions N+1, N+2, and N+3 are set as a forward-side intermediate position between the neutral position N and the forward position F. However, in another example, any number of forward-side intermediate positions other than three may be set as the forward-side intermediate positions between the neutral position N and the forward position F.

[0060] In the example shown in FIG. **3**, a rotation angle θ of the bucket **12**B required to move the bucket **12**B from the neutral position N to the forward position F is divided into four. A position where the bucket **12**B is rotated by (θ/4) from the neutral position N is set as the forward-side intermediate position N+1, a position where the bucket **12**B is rotated by (2θ/4) from the neutral position N is set as the forward-side intermediate position N+2, and a position where the bucket **12**B is rotated by (3θ/4) from the neutral position N is set as the forward-side intermediate position N+3.

[0061] In the example shown in FIG. **3**, the forward-side intermediate positions N+1, N+2, and N+3 are set at the positions obtained by dividing the rotation angle θ of the bucket **12**B required to move the bucket **12**B from the neutral position N to the forward position F at equal angular intervals. However, in another example, a rotation angle of the bucket **12**B required to move the bucket **12**B from the neutral position N to the forward-side intermediate position N+1, a rotation angle of the bucket **12**B required to move the bucket **12**B from the forward-side intermediate position N+1 to the forward-side intermediate position N+2, a rotation angle of the bucket **12**B required to move the bucket **12**B from the forward-side intermediate position N+2 to the forward-side intermediate position N+3, and a rotation angle of the bucket **12**B required to move the bucket **12**B from the forward-side intermediate position N+3 to the forward position F may be different from each other.

[0062] In the example shown in FIG. **3**, when the ship controller **13** is in the ship fixed point holding mode, the ship controller **13** performs both control of the position of the bucket **12**B (control of disposing the bucket **12**B at any of the neutral position N, the forward-side intermediate positions N+1, N+2, and N+3, and the forward position F) and control of the rotational speed of the engine **11**.

[0063] In detail, when the ship controller **13** is in the ship fixed point holding mode, the ship controller **13** performs control of setting the rotational speed of the engine **11** to a predetermined value so that the ship **1** is held at a fixed point of the target ship position, and setting the position of the bucket **12**B to any of the forward position F, the neutral position N, and the three forward-side intermediate positions N+1, N+2, and N+3.

TABLE 1

Deviation	0	+1	+2	+3	+4	+5	+6	. . .
Control amount	0	+1	+2	+3	+4	+5	+6	. . .
Bucket position	N	N + 1	N + 2	N + 3	F	F	F	. . .
Engine rotational speed	IDLE	IDLE	IDLE	IDLE	IDLE	IDLE + 1	IDLE + 2	. . .

[0064] Table 1 shows an example of a correspondence between the rotational speed of the engine **11**, the position of the bucket **12**B, and the like when the ship controller **13** is in the ship fixed point holding mode.

[0065] In the example shown in Table 1, when a deviation between the target ship position and the actual ship position in the ship fixed point holding mode of the ship controller **13** is zero, a control amount (feedback control amount) calculated by the ship controller **13** is zero. As a result, the bucket position control unit **13**A of the ship controller **13** disposes the bucket **12**B at the neutral position N. In detail, the bucket position control unit **13**A controls the position of the bucket **12**B to the neutral position N even when the shift operation unit **15**B does not receive an input operation from the ship operator. The engine rotational speed control unit **13**B of the ship controller **13** controls the rotational speed of the engine **11** to "IDLE" (the rotational speed of the engine **11** in an idling state). In detail, the engine rotational speed control unit **13**B controls the rotational speed of the engine **11** to "IDLE" even when the throttle operation unit **15**A does not receive an input operation from the ship operator. For this reason, the jet propulsion device **12** does not generate a propulsive force for moving the ship **1**, and the ship **1** is held at the target ship position.

[0066] In the example shown in Table 1, when a deviation between the target ship position and the actual ship position in the ship fixed point holding mode of the ship controller **13** is "+1" (that is, when the actual ship position deviates from the target ship position to the rear side of the ship **1** by an amount corresponding to the deviation "+1"), the control amount calculated by the ship controller **13** is "+1". As a result, the bucket position control unit **13**A of the ship controller **13** disposes the bucket **12**B at the forward-side intermediate position N+1. In detail, the bucket position control unit **13**A controls the position of the bucket **12**B to the forward-side intermediate position N+1 even when the shift operation unit **15**B does not receive an input operation from the ship operator. The engine rotational speed control unit **13**B of the ship controller **13** controls the rotational speed of the engine **11** to "IDLE". In detail, the engine rotational speed control unit **13**B controls the rotational speed of the engine **11** to "IDLE" even when the throttle operation unit **15**A does not receive an input operation from the ship operator. Thereby, the jet propulsion device **12** generates a propulsive force for moving the ship **1** forward

to reduce the deviation from "+1" to zero, and the ship **1** is held at the target ship position.

[0067] In the example shown in Table 1, when a deviation between the target ship position and the actual ship position in the ship fixed point holding mode of the ship controller **13** is "+2" (>the deviation "+1") (that is, when the actual ship position deviates from the target ship position to the rear side of the ship **1** by an amount corresponding to the deviation "+2"), the control amount calculated by the ship controller **13** is "+2" (>the control amount "+1"). As a result, the bucket position control unit **13**A of the ship controller **13** disposes the bucket **12**B at the forward-side intermediate position N+2. In detail, the bucket position control unit **13**A controls the position of the bucket **12**B to the forward-side intermediate position N+2 even when the shift operation unit **15**B does not receive an input operation from the ship operator. The engine rotational speed control unit **13**B of the ship controller **13** controls the rotational speed of the engine **11** to "IDLE". In detail, the engine rotational speed control unit **13**B controls the rotational speed of the engine **11** to "IDLE" even when the throttle operation unit **15**A does not receive an input operation from the ship operator. Thereby, the jet propulsion device **12** generates a propulsive force for moving the ship **1** forward to reduce the deviation from "+2" to zero, and the ship **1** is held at the target ship position.

[0068] In the example shown in Table 1, when a deviation between the target ship position and the actual ship position in the ship fixed point holding mode of the ship controller **13** is "+3" (>the deviation "+2") (that is, when the actual ship position deviates from the target ship position to the rear side of the ship **1** by an amount corresponding to the deviation "+3"), the control amount calculated by the ship controller **13** is "+3" (>the control amount "+2"). As a result, the bucket position control unit **13**A of the ship controller **13** disposes the bucket **12**B at the forward-side intermediate position N+3. In detail, the bucket position control unit **13**A controls the position of the bucket **12**B to the forward-side intermediate position N+3 even when the shift operation unit **15**B does not receive an input operation from the ship operator. The engine rotational speed control unit **13**B of the ship controller **13** controls the rotational speed of the engine **11** to "IDLE". In detail, the engine rotational speed control unit **13**B controls the rotational speed of the engine **11** to "IDLE" even when the throttle operation unit **15**A does not receive an input operation from the ship operator. Thereby, the jet propulsion device **12** generates a propulsive force for moving the ship **1** forward to reduce the deviation from "+3" to zero, and the ship **1** is held at the target ship position.

[0069] In the example shown in Table 1, when a deviation between the target ship position and the actual ship position in the ship fixed point holding mode of the ship controller **13** is "+4" (>the deviation "+3") (that is, when the actual ship position deviates from the target ship position to the rear side of the ship **1** by an amount corresponding to the deviation "+4"), the control amount calculated by the ship controller **13** is "+4" (>the control amount "+3"). As a result, the bucket position control unit **13**A of the ship controller **13** disposes the bucket **12**B at the forward position F. In detail, the bucket position control unit **13**A controls the position of the bucket **12**B to the forward position F even when the shift operation unit **15**B does not receive an input operation from the ship operator. The engine rotational speed control unit **13**B of the ship controller **13** controls the rotational speed of the engine **11** to "IDLE". In detail, the engine rotational speed control unit **13**B controls the rotational speed of the engine **11** to "IDLE" even when the throttle operation unit **15**A does not receive an input operation from the ship operator. Thereby, the jet propulsion device **12** generates a propulsive force for moving the ship **1** forward to reduce the deviation from "+4" to zero, and the ship **1** is held at the target ship position.

[0070] In the example shown in Table 1, when a deviation between the target ship position and the actual ship position in the ship fixed point holding mode of the ship controller **13** is "+5" (>the deviation "+4") (that is, when the actual ship position deviates from the target ship position to the rear side of the ship **1** by an amount corresponding to the deviation "+5"), the control amount calculated by the ship controller **13** is "+5" (>the control amount "+4"). As a result, the bucket position control unit **13**A of the ship controller **13** disposes the bucket **12**B at the forward position F. In detail, the bucket position control unit **13**A controls the position of the bucket **12**B to the forward position F even when the shift operation unit **15**B does not receive an input operation from the ship operator. The engine rotational speed control unit **13**B of the ship controller **13** controls the rotational speed of the engine **11** to "IDLE+1" (>the rotational speed "IDLE" of the engine **11**). In detail, the engine rotational speed control unit **13**B controls the rotational speed of the engine **11** to "IDLE+1" even when the throttle operation unit **15**A does not receive an input operation from the ship operator. Thereby, the jet propulsion device **12** generates a propulsive force for moving the ship **1** forward to reduce the deviation from "+5" to zero, and the ship **1** is held at the target ship position.

[0071] In the example shown in Table 1, when a deviation between the target ship position and the actual ship position in the ship fixed point holding mode of the ship controller **13** is "+6" (>the deviation "+5") (that is, when the actual ship position deviates from the target ship position to the rear side of the ship **1** by an amount corresponding to the deviation "+6""), the control amount calculated by the ship controller **13** is "+6" (>the control amount "+5"). As a result, the bucket position control unit **13**A of the ship controller **13** disposes the bucket **12**B at the forward position F. In detail, the bucket position control unit **13**A controls the position of the bucket **12**B to the forward position F even when the shift operation unit **15**B does not receive an input operation from the ship operator. The engine rotational speed control unit **13**B of the ship controller **13** controls the rotational speed of the engine **11** to "IDLE+2" (>the rotational speed "IDLE+1" of the engine **11**). In detail, the engine rotational speed control unit **13**B controls the rotational speed of the engine **11** to "IDLE+2" even when the throttle operation unit **15**A does not receive an input operation from the ship operator. Thereby, the jet propulsion device **12** generates a propulsive force for moving the ship **1** forward to reduce the deviation from "+6" to zero, and the ship **1** is held at the target ship position.

[0072] In the example shown in Table 1, when the actual ship position is located behind the target ship position if the position of the bucket **12**B is set to be the neutral position N in the ship fixed point holding mode of the ship controller **13**, and when the actual ship position is located ahead of the target ship position (that is, when a relatively small backward external force is applied to the ship **1**) if the position of the bucket **12**B is set to be the forward position F, the position of the bucket **12**B is set to be, for example, the

forward-side intermediate position N+1, the forward-side intermediate position N+2, the forward-side intermediate position N+3, and the like, and the rotational speed of the engine **11** is set to "IDLE" so that the ship **1** is held at a fixed point of the target ship position.

[0073] That is, in the example shown in Table 1, the forward-side intermediate positions N+1, N+2, and N+3 are set as the position of the bucket **12**B, and both the control of the position of the bucket **12**B and control of the rotational speed of the engine **11** are performed when the ship controller **13** is in the ship fixed point holding mode. Thus, for example, when a deviation between the target ship position and the actual ship position is "+1", "+2", or "+3", it is possible to prevent the ship **1** from excessively moving ahead of the target ship position due to the bucket **12**B being disposed at the forward position F.

[0074] That is, in the ship **1** according to the first embodiment, it is possible to improve controllability of ship fixed point holding as compared to when the forward-side intermediate positions N+1, N+2, and N+3 are not set as the position of the bucket **12**B, and when both the control of the position of the bucket **12**B and the control of the rotational speed of the engine **11** are not performed in the ship fixed point holding mode of the ship controller **13**.

[0075] In the example shown in Table 1, the rotational speed of the engine **11** is controlled to "IDLE" when the position of the bucket **12**B is set to be the forward-side intermediate positions N+1, N+2, and N+3. However, in another example, when the position of the bucket **12**B is set to be the forward-side intermediate positions N+1, N+2, and N+3, the rotational speed of the engine **11** may be controlled to a rotational speed (for example, "IDLE+1", "IDLE+2", or the like) other than "IDLE". Specifically, when the position of the bucket **12**B changes in the order of the forward-side intermediate position N+1→the forward-side intermediate position N+2→the forward-side intermediate position N+3, the rotational speed of the engine **11** may change in the order of, for example, "IDLE" →"IDLE+1" →"IDLE+2".

[0076] FIG. **4** is a flowchart showing an example of processing performed by the ship controller **13** of the ship **1** according to the first embodiment.

[0077] In the example shown in FIG. **4**, in step S**10**, the ship controller **13** determines whether it is a ship fixed point holding mode (determines whether it is a ship fixed point holding mode or a normal mode). When the ship controller **13** is in the ship fixed point holding mode, the processing proceeds to step S**11**, and when the ship controller **13** is in the normal mode, the processing proceeds to step S**12**.

[0078] In step S**11**, the ship controller **13** performs feedback control of the engine **11** and jet propulsion device **12** based on a deviation between the target ship position and the actual ship position. In detail, the ship controller **13** performs control of holding the ship **1** at the target ship position (performs fixed point holding of the ship **1**).

[0079] Specifically, in step S**11**A, the bucket position control unit **13**A of the ship controller **13** controls the position of the bucket **12**B. In the above-described example shown in FIG. **3**, the position of the bucket **12**B includes the neutral position N, the forward position F, and the forward-side intermediate positions N+1, N+2, and N+3.

[0080] In step S**11**B, the engine rotational speed control unit **13**B of the ship controller **13** controls the rotational speed of the engine **11**.

[0081] That is, when step S**11** is performed, both the control of the position of the bucket **12**B including the forward-side intermediate positions N+1, N+2, and N+3 and the control of the rotational speed of the engine **11** are performed.

[0082] In step S**12**, the ship controller **13** controls the normal mode. Specifically, the bucket position control unit **13**A controls the position of the bucket **12**B to any of the forward position F, the neutral position N, and the reverse position R based on the ship operator's input operation received by the shift operation unit **15**B. The engine rotational speed control unit **13**B controls the rotational speed of the engine **11** based on the ship operator's input operation received by the throttle operation unit **15**A.

Second Embodiment

[0083] Hereinafter, a second embodiment of a ship, a ship controller, a ship control method and a non-transitory computer readable medium of the present invention will be described.

[0084] A ship **1** according to the second embodiment is configured in the same manner as the ship **1** according to the first embodiment described above, except for points to be described below. Thus, according to the ship **1** of the second embodiment, it is possible to achieve the same effects as those of the ship **1** according to the first embodiment described above, except for points to be described below.

[0085] Similarly, to the ship **1** according to the first embodiment shown in FIG. **1**, the ship **1** according to the second embodiment includes, for example, an engine **11**, a jet propulsion device **12**, a ship controller **13**, a ship position detection unit **14**, and an operation unit **15**. A bucket **12**B of the jet propulsion device **12** of the ship **1** according to the second embodiment is configured to be able to be disposed at a forward position F, a neutral position N, and a reverse position R.

[0086] A bucket position control unit **13**A of the ship controller **13** of the ship **1** according to the second embodiment controls the position of the bucket **12**B (for example, control of disposing the bucket **12**B at the forward position F, control of disposing the bucket **12**B at the neutral position N, control of disposing the bucket **12**B at the reverse position R, and the like).

[0087] An engine rotational speed control unit **13**B of the ship controller **13** of the ship **1** according to the second embodiment controls the rotational speed of the engine **11** (that is, control of changing the strength of the jet stream shown in FIG. **2**).

[0088] Similarly, to the ship controller **13** of the ship **1** according to the first embodiment, the ship controller **13** of the ship **1** according to the second embodiment not only has the above-mentioned normal mode but also has a ship fixed point holding mode. In the ship fixed point holding mode, the ship controller **13** of the ship **1** according to the second embodiment performs feedback control (for example, PID control and the like) of the engine **11** and the jet propulsion device **12** based on a deviation between a target ship position, which is a preset target position of the ship **1**, and the actual ship position.

[0089] FIG. **5** is a diagram showing the position of the bucket **12**B which is controlled by the bucket position control unit **13**A of the ship controller **13** when the ship controller **13** of the ship **1** according to the second embodiment is in the ship fixed point holding mode.

[0090] In the example shown in FIG. **5**, when the ship controller **13** is in the ship fixed point holding mode, a neutral position N, a forward position F, and a linear forward-side intermediate position NF that can be linearly adjusted between the neutral position N and the forward position F are set as the position of the bucket **12**B that can be disposed by the bucket position control unit **13**A of the ship controller **13**.

[0091] That is, the position of the bucket **12**B that can be disposed by the bucket position control unit **13**A in the ship fixed point holding mode of the ship controller **13** includes the neutral position N, the forward position F, and the linear forward-side intermediate position NF that can be linearly adjusted between the neutral position N and the forward position F.

[0092] In the example shown in FIG. **5**, when the ship controller **13** is in the ship fixed point holding mode, the ship controller **13** performs both control of the position of the bucket **12**B (control of disposing the bucket **12**B at any of the neutral position N, the linear forward-side intermediate position NF, and the forward position F) and control of the rotational speed of the engine **11**.

[0093] In detail, when the ship controller **13** is in the ship fixed point holding mode, the ship controller **13** performs control of setting the rotational speed of the engine **11** to a predetermined value so that the ship **1** is held at a fixed point of the target ship position, and setting the position of the bucket **12**B to any of the forward position F, the neutral position N, and the linear forward-side intermediate position NF.

TABLE 2

Deviation	0	+1	+2	+3	+4	+5	+6	. . .
Control amount	0	+1	+2	+3	+4	+5	+6	. . .
Bucket position	N	NF	NF	NF	F	F	F	. . .
Engine rotational speed	IDLE	IDLE	IDLE	IDLE	IDLE	IDLE + 1	IDLE + 2	. . .

[0094] Table 2 shows an example of a correspondence between the rotational speed of the engine **11**, the position of the bucket **12**B, and the like when the ship controller **13** of the ship **1** according to the second embodiment is in the ship fixed point holding mode.

[0095] In the example shown in Table 2, a control amount (feedback control amount) calculated by the ship controller **13** is zero when a deviation between the target ship position and the actual ship position in the ship fixed point holding mode of the ship controller **13** is zero. As a result, the bucket position control unit **13**A of the ship controller **13** disposes the bucket **12**B at the neutral position N. The engine rotational speed control unit **13**B of the ship controller **13** controls the rotational speed of the engine **11** to "IDLE" (the rotational speed of the engine **11** in an idling state). For this reason, the jet propulsion device **12** does not generate a propulsive force for moving the ship **1**, and the ship **1** is held at the target ship position.

[0096] In the example shown in Table 2, when a deviation between the target ship position and the actual ship position in the ship fixed point holding mode of the ship controller **13** is "+1" (that is, when the actual ship position deviates from the target ship position to the rear side of the ship **1** by an amount corresponding to the deviation "+1"), the control amount calculated by the ship controller **13** is "+1". As a result, the bucket position control unit **13**A of the ship controller **13** disposes the bucket **12**B at the linear forward-side intermediate position NF. In detail, the bucket position control unit **13**A adjusts the position of the bucket **12**B to a position close to the neutral position N at the linear forward-side intermediate position NF. The engine rotational speed control unit **13**B of the ship controller **13** controls the rotational speed of the engine **11** to "IDLE". Thereby, the jet propulsion device **12** generates a propulsive force for moving the ship **1** forward to reduce the deviation from "+1" to zero, and the ship **1** is held at the target ship position.

[0097] In the example shown in Table 2, when a deviation between the target ship position and the actual ship position in the ship fixed point holding mode of the ship controller **13** is "+2" (>the deviation "+1") (that is, when the actual ship position deviates from the target ship position to the rear side of the ship **1** by an amount corresponding to the deviation "+2"), the control amount calculated by the ship controller **13** is "+2" (>the control amount "+1"). As a result, the bucket position control unit **13**A of the ship controller **13** disposes the bucket **12**B at the linear forward-side intermediate position NF. In detail, the bucket position control unit **13**A adjusts the position of the bucket **12**B to a position between the neutral position N at the linear forward-side intermediate positions NF and the forward position F. The engine rotational speed control unit **13**B of the ship controller **13** controls the rotational speed of the engine **11** to "IDLE". Thereby, the jet propulsion device **12** generates a propulsive force for moving the ship **1** forward to reduce the deviation from "+2" to zero, and the ship **1** is held at the target ship position.

[0098] In the example shown in Table 2, when a deviation between the target ship position and the actual ship position in the ship fixed point holding mode of the ship controller **13** is "+3" (>the deviation "+2") (that is, when the actual ship position deviates from the target ship position to the rear side of the ship **1** by an amount corresponding to the deviation "+3"), the control amount calculated by the ship controller **13** is "+3" (>the control amount "+2"). As a result, the bucket position control unit **13**A of the ship controller **13** disposes the bucket **12**B at the linear forward-side intermediate position NF. In detail, the bucket position control unit **13**A adjusts the position of the bucket **12**B to a position close to the forward position F at the linear forward-side intermediate position NF. The engine rotational speed control unit **13**B of the ship controller **13** controls the rotational speed of the engine **11** to "IDLE". Thereby, the jet propulsion device **12** generates a propulsive force for moving the ship **1** forward to reduce the deviation from "+3" to zero, and the ship **1** is held at the target ship position.

[0099] In the example shown in Table 2, when a deviation between the target ship position and the actual ship position in the ship fixed point holding mode of the ship controller **13** is "+4" (>the deviation "+3") (that is, when the actual ship position deviates from the target ship position to the rear side of the ship **1** by an amount corresponding to the deviation "+4"), the control amount calculated by the ship controller

13 is "+4" (>the control amount "+3"). As a result, the bucket position control unit 13A of the ship controller 13 disposes the bucket 12B at the forward position F. The engine rotational speed control unit 13B of the ship controller 13 controls the rotational speed of the engine 11 to "IDLE". Thereby, the jet propulsion device 12 generates a propulsive force for moving the ship 1 forward to reduce the deviation from "+4" to zero, and the ship 1 is held at the target ship position.

[0100] In the example shown in Table 2, when a deviation between the target ship position and the actual ship position in the ship fixed point holding mode of the ship controller 13 is "+5" (>the deviation "+4") (that is, when the actual ship position deviates from the target ship position to the rear side of the ship 1 by an amount corresponding to the deviation "+5"), the control amount calculated by the ship controller 13 is "+5" (>the control amount "+4"). As a result, the bucket position control unit 13A of the ship controller 13 disposes the bucket 12B at the forward position F. The engine rotational speed control unit 13B of the ship controller 13 controls the rotational speed of the engine 11 to "IDLE+1" (>the rotational speed "IDLE" of the engine 11). Thereby, the jet propulsion device 12 generates a propulsive force for moving the ship 1 forward to reduce the deviation from "+5" to zero, and the ship 1 is held at the target ship position.

[0101] In the example shown in Table 2, when a deviation between the target ship position and the actual ship position in the ship fixed point holding mode of the ship controller 13 is "+6" (>the deviation "+5") (that is, when the actual ship position deviates from the target ship position to the rear side of the ship 1 by an amount corresponding to the deviation "+6""), the control amount calculated by the ship controller 13 is "+6" (>the control amount "+5"). As a result, the bucket position control unit 13A of the ship controller 13 disposes the bucket 12B at the forward position F. The engine rotational speed control unit 13B of the ship controller 13 controls the rotational speed of the engine 11 to "IDLE+2" (>the rotational speed "IDLE+1" of the engine 11). Thereby, the jet propulsion device 12 generates a propulsive force for moving the ship 1 forward to reduce the deviation from "+6" to zero, and the ship 1 is held at the target ship position.

[0102] In the example shown in Table 2, when the actual ship position is located behind the target ship position if the position of the bucket 12B is set to be the neutral position N in the ship fixed point holding mode of the ship controller 13, and when the actual ship position is located ahead of the target ship position (that is, when a relatively small backward external force is applied to the ship 1) if the position of the bucket 12B is set to be the forward position F, the position of the bucket 12B is set to be the linear forward-side intermediate position NF, and the rotational speed of the engine 11 is set to "IDLE" so that the ship 1 is held at a fixed point of the target ship position.

[0103] That is, in the example shown in Table 2, the linear forward-side intermediate position NF is set as the position of the bucket 12B, and both the control of the position of the bucket 12B and control of the rotational speed of the engine 11 are performed when the ship controller 13 is in the ship fixed point holding mode. Thus, for example, when a deviation between the target ship position and the actual ship position is "+1", "+2", or "+3", it is possible to prevent the ship 1 from excessively moving ahead of the target ship position due to the bucket 12B being disposed at the forward position F.

[0104] That is, in the ship 1 according to the second embodiment, it is possible to improve controllability of ship fixed point holding as compared to when the linear forward-side intermediate position NF is not set as the position of the bucket 12B, and when both the control of the position of the bucket 12B and the control of the rotational speed of the engine 11 are not performed in the ship fixed point holding mode of the ship controller 13.

[0105] In the example shown in Table 2, the rotational speed of the engine 11 is controlled to "IDLE" when the position of the bucket 12B is set to be the linear forward-side intermediate position NF. However, in another example, the position of the bucket 12B is set to be the linear forward-side intermediate position NF, the rotational speed of the engine 11 may be controlled to a rotational speed (for example, "IDLE+1", "IDLE+2", or the like) other than "IDLE". Specifically, when the position of the bucket 12B changes in the order of a position close to the neutral position N at the linear forward-side intermediate positions NF→a position between the neutral position N at the linear forward-side intermediate positions NF and the forward position F→a position close to the forward position F at the linear forward-side intermediate position NF, the rotational speed of the engine 11 may change in the order of, for example, "IDLE" →"IDLE+1" →"IDLE+2".

Third Embodiment

[0106] Hereinafter, a third embodiment of a ship, a ship controller, a ship control method and a non-transitory computer readable medium of the present invention will be described.

[0107] The ship 1 according to the third embodiment is configured in the same manner as the ship 1 according to the first embodiment described above, except for points to be described below. Thus, according to the ship 1 of the third embodiment, it is possible to achieve the same effects as those of the ship 1 according to the first embodiment described above, except for points to be described below.

[0108] Similarly, to the ship 1 according to the first embodiment shown in FIG. 1, the ship 1 according to the third embodiment includes, for example, an engine 11, a jet propulsion device 12, a ship controller 13, a ship position detection unit 14, and an operation unit 15. A bucket 12B of the jet propulsion device 12 of the ship 1 according to the third embodiment is configured to be able to be disposed at a forward position F, a neutral position N, and a reverse position R.

[0109] A bucket position control unit 13A of the ship controller 13 of the ship 1 according to the third embodiment controls the position of the bucket 12B (for example, control of disposing the bucket 12B at the forward position F, control of disposing the bucket 12B at the neutral position N, control of disposing the bucket 12B at the reverse position R, and the like).

[0110] An engine rotational speed control unit 13B of the ship controller 13 of the ship 1 according to the third embodiment controls the rotational speed of the engine 11 (that is, control of changing the strength of the jet stream shown in FIG. 2).

[0111] Similarly, to the ship controller 13 of the ship 1 according to the first embodiment, the ship controller 13 of

the ship **1** according to the third embodiment not only has the above-mentioned normal mode but also has a ship fixed point holding mode. In the ship fixed point holding mode, the ship controller **13** of the ship **1** according to the third embodiment performs feedback control (for example, PID control and the like) of the engine **11** and the jet propulsion device **12** based on a deviation between a target ship position, which is a preset target position of the ship **1**, and the actual ship position.

[0112] FIG. **6** is a diagram showing an example of the position of the bucket **12**B which is controlled by the bucket position control unit **13**A of the ship controller **13** when the ship controller **13** of the ship **1** according to the third embodiment is in the ship fixed point holding mode.

[0113] In the example shown in FIG. **6**, when the ship controller **13** is in the ship fixed point holding mode, a neutral position N, a reverse position R, and three reverse-side intermediate positions N−1, N−2, and N−3 located therebetween are set as the position of the bucket **12**B that can be disposed by the bucket position control unit **13**A of the ship controller **13**.

[0114] That is, the position of the bucket **12**B that can be disposed by the bucket position control unit **13**A in the ship fixed point holding mode of the ship controller **13** includes the neutral position N, the reverse-side intermediate position N−1, the reverse-side intermediate position N−2, the reverse-side intermediate position N−3, and the reverse position R.

[0115] In the example shown in FIG. **6**, the three reverse-side intermediate positions N−1, N−2, and N−3 are set as a reverse-side intermediate position between the neutral position N and the reverse position R. However, in another example, any number of reverse-side intermediate positions other than three may be set as the reverse-side intermediate positions between the neutral position N and the reverse position R.

[0116] In the example shown in FIG. **6**, a rotation angle θ of the bucket **12**B required to move the bucket **12**B from the neutral position N to the reverse position R is divided into four. A position where the bucket **12**B is rotated by (θ/4) from the neutral position N is set as the reverse-side intermediate position N−1, a position where the bucket **12**B is rotated by (2θ/4) from the neutral position N is set as the reverse-side intermediate position N−2, and a position where the bucket **12**B is rotated by (3θ/4) from the neutral position N is set as the reverse-side intermediate position N−3.

[0117] In the example shown in FIG. **6**, the reverse-side intermediate positions N−1, N−2, N−3 are set at the positions obtained by dividing the rotation angle θ of the bucket **12**B required to move the bucket **12**B from the neutral position N to the reverse position R at equal angular intervals. However, in another example, a rotation angle of the bucket **12**B required to move the bucket **12**B from the neutral position N to the reverse-side intermediate position N−1, a rotation angle of the bucket **12**B required to move the bucket **12**B from the reverse-side intermediate position N−1 to the reverse-side intermediate position N−2, a rotation angle of the bucket **12**B required to move the bucket **12**B from the reverse-side intermediate position N−2 to the reverse-side intermediate position N−3, and a rotation angle of the bucket **12**B required to move the bucket **12**B from the reverse-side intermediate position N−3 to the reverse position R may be different from each other.

[0118] In the example shown in FIG. **6**, when the ship controller **13** is in the ship fixed point holding mode, the ship controller **13** performs both control of the position of the bucket **12**B (control of disposing the bucket **12**B at any of the neutral position N, the reverse-side intermediate positions N−1, N−2, and N−3, and the reverse position R) and control of the rotational speed of the engine **11**.

[0119] In detail, when the ship controller **13** is in the ship fixed point holding mode, the ship controller **13** performs control of setting the rotational speed of the engine **11** to a predetermined value so that the ship **1** is held at a fixed point of the target ship position, and setting the position of the bucket **12**B to any of the reverse position R, the neutral position N, and the three reverse-side intermediate positions N−1, N−2, and N−3.

TABLE 3

Deviation	...	−6	−5	−4	−3	−2	−1	0
Control amount	...	−6	−5	−4	−3	−2	−1	0
Bucket position	...	R	R	R	N − 3	N − 2	N − 1	N
Engine rotational speed	...	IDLE + 2	IDLE + 1	IDLE	IDLE	IDLE	IDLE	IDLE

[0120] Table 3 shows an example of a correspondence between the rotational speed of the engine **11**, the position of the bucket **12**B, and the like when the ship controller **13** of the ship **1** according to the third embodiment is in the ship fixed point holding mode.

[0121] In the example shown in Table 3, a control amount (feedback control amount) calculated by the ship controller **13** is zero when a deviation between the target ship position and the actual ship position in the ship fixed point holding mode of the ship controller **13** is zero. As a result, the bucket position control unit **13**A of the ship controller **13** disposes the bucket **12**B at the neutral position N. In detail, the bucket position control unit **13**A controls the position of the bucket **12**B to the neutral position N even when the shift operation unit **15**B does not receive an input operation from the ship operator. The engine rotational speed control unit **13**B of the ship controller **13** controls the rotational speed of the engine **11** to "IDLE" (the rotational speed of the engine **11** in an idling state). In detail, the engine rotational speed control unit **13**B controls the rotational speed of the engine **11** to "IDLE" even when the throttle operation unit **15**A does not receive an input operation from the ship operator. For this reason, the jet propulsion device **12** does not generate a propulsive force for moving the ship **1**, and the ship **1** is held at the target ship position.

[0122] In the example shown in Table 3, when a deviation between the target ship position and the actual ship position in the ship fixed point holding mode of the ship controller **13** is "−1" (that is, when the actual ship position deviates from the target ship position to the front side of the ship **1** an amount corresponding to the deviation "−1"), the control amount calculated by the ship controller **13** is "−1". As a result, the bucket position control unit **13**A of the ship

controller **13** disposes the bucket **12**B at the reverse-side intermediate position N−1. In detail, the bucket position control unit **13**A controls the position of the bucket **12**B to the reverse-side intermediate position N−1 even when the shift operation unit **15**B does not receive an input operation from the ship operator. The engine rotational speed control unit **13**B of the ship controller **13** controls the rotational speed of the engine **11** to "IDLE". In detail, the engine rotational speed control unit **13**B controls the rotational speed of the engine **11** to "IDLE" even when the throttle operation unit **15**A does not receive an input operation from the ship operator. Thereby, the jet propulsion device **12** generates a propulsive force for moving the ship **1** backward to reduce the deviation from "−1" to zero, and the ship **1** is held at the target ship position.

[0123] In the example shown in Table 3, when a deviation between the target ship position and the actual ship position in the ship fixed point holding mode of the ship controller **13** is "−2" (that is, the actual ship position deviates from the target ship position to the front side of the ship **1** by an amount corresponding to the deviation "−2"), the control amount calculated by the ship controller **13** is "−2". As a result, the bucket position control unit **13**A of the ship controller **13** disposes the bucket **12**B at the reverse-side intermediate position N−2. In detail, the bucket position control unit **13**A controls the position of the bucket **12**B to the reverse-side intermediate position N−2 even when the shift operation unit **15**B does not receive an input operation from the ship operator. The engine rotational speed control unit **13**B of the ship controller **13** controls the rotational speed of the engine **11** to "IDLE". In detail, the engine rotational speed control unit **13**B controls the rotational speed of the engine **11** to "IDLE" even when the throttle operation unit **15**A does not receive an input operation from the ship operator. Thereby, the jet propulsion device **12** generates a propulsive force for moving the ship **1** backward to reduce the deviation from "−2" to zero, and the ship **1** is held at the target ship position.

[0124] In the example shown in Table 3, when a deviation between the target ship position and the actual ship position in the ship fixed point holding mode of the ship controller **13** is "−3" (that is, the actual ship position deviates from the target ship position to the front side of the ship **1** by an amount corresponding to the deviation "−3"), the control amount calculated by the ship controller **13** is "−3". As a result, the bucket position control unit **13**A of the ship controller **13** disposes the bucket **12**B at the reverse-side intermediate position N−3. In detail, the bucket position control unit **13**A controls the position of the bucket **12**B to the reverse-side intermediate position N−3 even when the shift operation unit **15**B does not receive an input operation from the ship operator. The engine rotational speed control unit **13**B of the ship controller **13** controls the rotational speed of the engine **11** to "IDLE". In detail, the engine rotational speed control unit **13**B controls the rotational speed of the engine **11** to "IDLE" even when the throttle operation unit **15**A does not receive an input operation from the ship operator. Thereby, the jet propulsion device **12** generates a propulsive force for moving the ship **1** backward to reduce the deviation from "−3" to zero, and the ship **1** is held at the target ship position.

[0125] In the example shown in Table 3, when a deviation between the target ship position and the actual ship position in the ship fixed point holding mode of the ship controller **13** is "−4" (that is, the actual ship position deviates from the target ship position to the front side of the ship **1** by an amount corresponding to the deviation "−4"), the control amount calculated by the ship controller **13** is "−4". As a result, the bucket position control unit **13**A of the ship controller **13** disposes the bucket **12**B at the reverse position R. In detail, the bucket position control unit **13**A controls the position of the bucket **12**B to the reverse position R even when the shift operation unit **15**B does not receive an input operation from the ship operator. The engine rotational speed control unit **13**B of the ship controller **13** controls the rotational speed of the engine **11** to "IDLE". In detail, the engine rotational speed control unit **13**B controls the rotational speed of the engine **11** to "IDLE" even when the throttle operation unit **15**A does not receive an input operation from the ship operator. Thereby, the jet propulsion device **12** generates a propulsive force for moving the ship **1** backward to reduce the deviation from "−4" to zero, and the ship **1** is held at the target ship position.

[0126] In the example shown in Table 3, when a deviation between the target ship position and the actual ship position in the ship fixed point holding mode of the ship controller **13** is "−5" (that is, the actual ship position deviates from the target ship position to the front side of the ship **1** by an amount corresponding to the deviation "−5"), the control amount calculated by the ship controller **13** is "−5". As a result, the bucket position control unit **13**A of the ship controller **13** disposes the bucket **12**B at the reverse position R. In detail, the bucket position control unit **13**A controls the position of the bucket **12**B to the reverse position R even when the shift operation unit **15**B does not receive an input operation from the ship operator. The engine rotational speed control unit **13**B of the ship controller **13** controls the rotational speed of the engine **11** to "IDLE+1" (>the rotational speed "IDLE" of the engine **11**). In detail, the engine rotational speed control unit **13**B controls the rotational speed of the engine **11** to "IDLE+1" even when the throttle operation unit **15**A does not receive an input operation from the ship operator. Thereby, the jet propulsion device **12** generates a propulsive force for moving the ship **1** backward to reduce the deviation from "−5" to zero, and the ship **1** is held at the target ship position.

[0127] In the example shown in Table 3, when a deviation between the target ship position and the actual ship position in the ship fixed point holding mode of the ship controller **13** is "−6" (that is, when the actual ship position deviates from the target ship position to the front side of the ship **1** an amount corresponding to the deviation "−6"), the control amount calculated by the ship controller **13** is "−6". As a result, the bucket position control unit **13**A of the ship controller **13** disposes the bucket **12**B at the reverse position R. In detail, the bucket position control unit **13**A controls the position of the bucket **12**B to the reverse position R even when the shift operation unit **15**B does not receive an input operation from the ship operator. The engine rotational speed control unit **13**B of the ship controller **13** controls the rotational speed of the engine **11** to "IDLE+2" (>the rotational speed "IDLE+1" of the engine **11**). In detail, the engine rotational speed control unit **13**B controls the rotational speed of the engine **11** to "IDLE+2" even when the throttle operation unit **15**A does not receive an input operation from the ship operator. Thereby, the jet propulsion device **12** generates a propulsive force for moving the ship

1 backward to reduce the deviation from "−6" to zero, and the ship 1 is held at the target ship position.

[0128] In the example shown in Table 3, when the actual ship position is located ahead of the target ship position if the position of the bucket 12B is set to be the neutral position N in the ship fixed point holding mode of the ship controller 13, and when the actual ship position is located behind the target ship position (that is, when a relatively small forward external force is applied to the ship 1) if the position of the bucket 12B is set to be the reverse position R, the position of the bucket 12B is set to be, for example, the reverse-side intermediate position N−1, the reverse-side intermediate position N−2, the reverse-side intermediate position N−3, and the like, and the rotational speed of the engine 11 is set to "IDLE" so that the ship 1 is held at a fixed point of the target ship position.

[0129] That is, in the example shown in Table 3, the reverse-side intermediate positions N−1, N−2, and N−3 are set as the position of the bucket 12B, and both the control of the position of the bucket 12B and control of the rotational speed of the engine 11 are performed when the ship controller 13 is in the ship fixed point holding mode. Thus, for example, when a deviation between the target ship position and the actual ship position is "−1", "−2", or "−3", it is possible to prevent the ship 1 from excessively moving to the rear side of the target ship position due to the bucket 12B being disposed at the reverse position R.

[0130] That is, in the ship 1 according to the third embodiment, it is possible to improve controllability of ship fixed point holding as compared to when the reverse-side intermediate positions N−1, N−2, and N−3 are not set as the position of the bucket 12B, and when both the control of the position of the bucket 12B and the control of the rotational speed of the engine 11 are not performed in the ship fixed point holding mode of the ship controller 13.

[0131] In the example shown in Table 3, the rotational speed of the engine 11 is controlled to "IDLE" when the position of the bucket 12B is set to be the reverse-side intermediate positions N−1, N−2, and N−3. However, in another example, when the position of the bucket 12B is set to be the reverse-side intermediate positions N−1, N−2, and N−3, the rotational speed of the engine 11 may be controlled to a rotational speed (for example, "IDLE+1", "IDLE+2", or the like) other than "IDLE". Specifically, when the position of the bucket 12B changes in the order of the reverse-side intermediate position N−1→the reverse-side intermediate position N−2→the reverse-side intermediate position N−3, the rotational speed of the engine 11 may change in the order of, for example, "IDLE" →"IDLE+1" →"IDLE+2".

[0132] FIG. 7 is a flowchart showing an example of processing performed by the ship controller 13 of the ship 1 according to the third embodiment.

[0133] In the example shown in FIG. 7, in step S30, the ship controller 13 determines whether it is a ship fixed point holding mode (determines whether it is a ship fixed point holding mode or a normal mode). When the ship controller 13 is in the ship fixed point holding mode, the processing proceeds to step S31, and when the ship controller 13 is in the normal mode, the processing proceeds to step S32.

[0134] In step S31, the ship controller 13 performs feedback control of the engine 11 and jet propulsion device 12 based on a deviation between the target ship position and the actual ship position. In detail, the ship controller 13 performs control of holding the ship 1 at the target ship position (performs fixed point holding of the ship 1).

[0135] Specifically, in step S31A, the bucket position control unit 13A of the ship controller 13 controls the position of the bucket 12B. In the above-described example shown in FIG. 6, the position of the bucket 12B includes the neutral position N, the reverse position R, and the reverse-side intermediate positions N−1, N−2, and N−3.

[0136] In step S31B, the engine rotational speed control unit 13B of the ship controller 13 controls the rotational speed of the engine 11.

[0137] That is, when step S31 is performed, both the control of the position of the bucket 12B including the reverse-side intermediate positions N−1, N−2, and N−3 and the control of the rotational speed of the engine 11 are performed.

[0138] In step S32, the ship controller 13 controls the normal mode. Specifically, the bucket position control unit 13A controls the position of the bucket 12B to any of the forward position F, the neutral position N, and the reverse position R based on the ship operator's input operation received by the shift operation unit 15B. The engine rotational speed control unit 13B controls the rotational speed of the engine 11 based on the ship operator's input operation received by the throttle operation unit 15A.

Fourth Embodiment

[0139] Hereinafter, a fourth embodiment of a ship, a ship controller, a ship control method and a non-transitory computer readable medium of the present invention will be described.

[0140] A ship 1 according to the fourth embodiment is configured in the same manner as the ship 1 according to the first embodiment described above, except for points to be described below. Thus, according to the ship 1 of the fourth embodiment, it is possible to achieve the same effects as those of the ship 1 according to the first embodiment described above, except for points to be described below.

[0141] Similarly, to the ship 1 according to the first embodiment shown in FIG. 1, the ship 1 according to the fourth embodiment includes, for example, an engine 11, a jet propulsion device 12, a ship controller 13, a ship position detection unit 14, and an operation unit 15. A bucket 12B of the jet propulsion device 12 of the ship 1 according to the fourth embodiment is configured to be able to be disposed at a forward position F, a neutral position N, and a reverse position R.

[0142] A bucket position control unit 13A of the ship controller 13 of the ship 1 according to the fourth embodiment controls the position of the bucket 12B (for example, control of disposing the bucket 12B at the forward position F, control of disposing the bucket 12B at the neutral position N, control of disposing the bucket 12B at the reverse position R, and the like).

[0143] An engine rotational speed control unit 13B of the ship controller 13 of the ship 1 according to the fourth embodiment controls the rotational speed of the engine 11 (that is, control of changing the strength of the jet stream shown in FIG. 2).

[0144] Similarly, to the ship controller 13 of the ship 1 according to the first embodiment, the ship controller 13 of the ship 1 according to the fourth embodiment not only has the above-mentioned normal mode but also has a ship fixed point holding mode. In the ship fixed point holding mode,

the ship controller **13** of the ship **1** according to the fourth embodiment performs feedback control (for example, PID control and the like) of the engine **11** and the jet propulsion device **12** based on a deviation between a target ship position, which is a preset target position of the ship **1**, and the actual ship position.

[0145] FIG. **8** is a diagram showing the position of the bucket **12**B which is controlled by the bucket position control unit **13**A of the ship controller **13** when the ship controller **13** of the ship **1** according to the fourth embodiment is in the ship fixed point holding mode.

[0146] In the example shown in FIG. **8**, when the ship controller **13** is in the ship fixed point holding mode, a neutral position N, a reverse position R, and a linear reverse-side intermediate position NR that can be linearly adjusted between the neutral position N and the reverse position R are set as the position of the bucket **12**B that can be disposed by the bucket position control unit **13**A of the ship controller **13**.

[0147] That is, the position of the bucket **12**B that can be disposed by the bucket position control unit **13**A in the ship fixed point holding mode of the ship controller **13** includes the neutral position N, the reverse position R, and the linear reverse-side intermediate position NR that can be linearly adjusted between the neutral position N and the reverse position R.

[0148] In the example shown in FIG. **8**, when the ship controller **13** is in the ship fixed point holding mode, the ship controller **13** performs both control of the position of the bucket **12**B (control of disposing the bucket **12**B at any of the neutral position N, the linear reverse-side intermediate position NR, and the reverse position R) and control of the rotational speed of the engine **11**.

[0149] In detail, when the ship controller **13** is in the ship fixed point holding mode, the ship controller **13** performs control of setting the rotational speed of the engine **11** to a predetermined value so that the ship **1** is held at a fixed point of the target ship position, and setting the position of the bucket **12**B to any of the reverse position R, the neutral position N, and the linear reverse-side intermediate position NR.

TABLE 4

Deviation	. . .	−6	−5	−4	−3	−2	−1	0
Control amount	. . .	−6	−5	−4	−3	−2	−1	0
Bucket position	. . .	R	R	R	NR	NR	NR	N
Engine rotational speed	. . .	IDLE + 2	IDLE + 1	IDLE	IDLE	IDLE	IDLE	IDLE

[0150] Table 4 shows an example of a correspondence between the rotational speed of the engine **11**, the position of the bucket **12**B, and the like when the ship controller **13** of the ship **1** according to the fourth embodiment is in the ship fixed point holding mode.

[0151] In the example shown in Table 4, a control amount (feedback control amount) calculated by the ship controller **13** is zero when a deviation between the target ship position and the actual ship position in the ship fixed point holding mode of the ship controller **13** is zero. As a result, the bucket position control unit **13**A of the ship controller **13** disposes the bucket **12**B at the neutral position N. The engine rotational speed control unit **13**B of the ship controller **13** controls the rotational speed of the engine **11** to "IDLE" (the rotational speed of the engine **11** in an idling state). For this reason, the jet propulsion device **12** does not generate a propulsive force for moving the ship **1**, and the ship **1** is held at the target ship position.

[0152] In the example shown in Table 4, when a deviation between the target ship position and the actual ship position in the ship fixed point holding mode of the ship controller **13** is "−1" (that is, when the actual ship position deviates from the target ship position to the front side of the ship **1** an amount corresponding to the deviation "−1"), the control amount calculated by the ship controller **13** is "−1". As a result, the bucket position control unit **13**A of the ship controller **13** disposes the bucket **12**B at the linear reverse-side intermediate position NR. In detail, the bucket position control unit **13**A adjusts the position of the bucket **12**B to a position close to the neutral position N at the linear reverse-side intermediate position NR. The engine rotational speed control unit **13**B of the ship controller **13** controls the rotational speed of the engine **11** to "IDLE". Thereby, the jet propulsion device **12** generates a propulsive force for moving the ship **1** backward to reduce the deviation from "−1" to zero, and the ship **1** is held at the target ship position.

[0153] In the example shown in Table 4, when a deviation between the target ship position and the actual ship position in the ship fixed point holding mode of the ship controller **13** is "−2" (that is, the actual ship position deviates from the target ship position to the front side of the ship **1** by an amount corresponding to the deviation "−2"), the control amount calculated by the ship controller **13** is "−2". As a result, the bucket position control unit **13**A of the ship controller **13** disposes the bucket **12**B at the linear reverse-side intermediate position NR. In detail, the bucket position control unit **13**A adjusts the position of the bucket **12**B to a position between the neutral position N at the linear reverse-side intermediate position NR and the reverse position R. The engine rotational speed control unit **13**B of the ship controller **13** controls the rotational speed of the engine **11** to "IDLE". Thereby, the jet propulsion device **12** generates a propulsive force for moving the ship **1** backward to reduce the deviation from "−2" to zero, and the ship **1** is held at the target ship position.

[0154] In the example shown in Table 4, when a deviation between the target ship position and the actual ship position in the ship fixed point holding mode of the ship controller **13** is "−3" (that is, the actual ship position deviates from the target ship position to the front side of the ship **1** by an amount corresponding to the deviation "−3"), the control amount calculated by the ship controller **13** is "−3". As a result, the bucket position control unit **13**A of the ship controller **13** disposes the bucket **12**B at the linear reverse-side intermediate position NR. In detail, the bucket position control unit **13**A adjusts the position of the bucket **12**B to a position close to the reverse position R at the linear reverse-side intermediate position NR. The engine rotational speed control unit **13**B of the ship controller **13** controls the rotational speed of the engine **11** to "IDLE". Thereby, the jet

propulsion device **12** generates a propulsive force for moving the ship **1** backward to reduce the deviation from "−3" to zero, and the ship **1** is held at the target ship position.

[0155] In the example shown in Table 4, when a deviation between the target ship position and the actual ship position in the ship fixed point holding mode of the ship controller **13** is "−4" (that is, the actual ship position deviates from the target ship position to the front side of the ship **1** by an amount corresponding to the deviation "−4"), the control amount calculated by the ship controller **13** is "−4". As a result, the bucket position control unit **13**A of the ship controller **13** disposes the bucket **12**B at the reverse position R. The engine rotational speed control unit **13**B of the ship controller **13** controls the rotational speed of the engine **11** to "IDLE". Thereby, the jet propulsion device **12** generates a propulsive force for moving the ship **1** backward to reduce the deviation from "−4" to zero, and the ship **1** is held at the target ship position.

[0156] In the example shown in Table 4, when a deviation between the target ship position and the actual ship position in the ship fixed point holding mode of the ship controller **13** is "−5" (that is, the actual ship position deviates from the target ship position to the front side of the ship **1** by an amount corresponding to the deviation "−5"), the control amount calculated by the ship controller **13** is "−5". As a result, the bucket position control unit **13**A of the ship controller **13** disposes the bucket **12**B at the reverse position R. The engine rotational speed control unit **13**B of the ship controller **13** controls the rotational speed of the engine **11** to "IDLE+1" (>the rotational speed "IDLE" of the engine **11**). Thereby, the jet propulsion device **12** generates a propulsive force for moving the ship **1** forward to reduce the deviation from "−5" to zero, and the ship **1** is held at the target ship position.

[0157] In the example shown in Table 4, when a deviation between the target ship position and the actual ship position in the ship fixed point holding mode of the ship controller **13** is "−6" (that is, when the actual ship position deviates from the target ship position to the front side of the ship **1** an amount corresponding to the deviation "−6"), the control amount calculated by the ship controller **13** is "−6". As a result, the bucket position control unit **13**A of the ship controller **13** disposes the bucket **12**B at the reverse position R. The engine rotational speed control unit **13**B of the ship controller **13** controls the rotational speed of the engine **11** to "IDLE+2" (>the rotational speed "IDLE+1" of the engine **11**). Thereby, the jet propulsion device **12** generates a propulsive force for moving the ship **1** backward to reduce the deviation from "−6" to zero, and the ship **1** is held at the target ship position.

[0158] In the example shown in Table 4, when the actual ship position is located ahead of the target ship position if the position of the bucket **12**B is set to be the neutral position N in the ship fixed point holding mode of the ship controller **13**, and when the actual ship position is located behind the target ship position (that is, when a relatively small forward external force is applied to the ship **1**) if the position of the bucket **12**B is set to be the reverse position R, the position of the bucket **12**B is set to be the linear reverse-side intermediate position NR, and the rotational speed of the engine **11** is set to "IDLE" so that the ship **1** is held at a fixed point of the target ship position.

[0159] That is, in the example shown in Table 4, the linear reverse-side intermediate position NR is set as the position of the bucket **12**B, and both the control of the position of the bucket **12**B and control of the rotational speed of the engine **11** are performed when the ship controller **13** is in the ship fixed point holding mode. Thus, for example, when a deviation between the target ship position and the actual ship position is "−1", "−2", or "−3", it is possible to prevent the ship **1** from excessively moving to the rear side of the target ship position due to the bucket **12**B being disposed at the reverse position R.

[0160] That is, in the ship **1** according to the fourth embodiment, it is possible to improve controllability of ship fixed point holding as compared to when the linear reverse-side intermediate position NR is not set as the position of the bucket **12**B, and when both the control of the position of the bucket **12**B and the control of the rotational speed of the engine **11** are not performed in the ship fixed point holding mode of the ship controller **13**.

[0161] In the example shown in Table 4, the rotational speed of the engine **11** is controlled to "IDLE" when the position of the bucket **12**B is set to be the linear reverse-side intermediate position NR. However, in another example, when the position of the bucket **12**B is set to be the linear reverse-side intermediate position NR, the rotational speed of the engine **11** may be controlled to a rotational speed (for example, "IDLE+1" "IDLE+2", or the like) other than "IDLE". Specifically, when the position of the bucket **12**B changes in the order of a position close to the neutral position N at the linear reverse-side intermediate positions NR→a position between the neutral position N at the linear reverse-side intermediate positions NR and the reverse positionR→a position close to the reverse position R at the linear reverse-side intermediate position NR, the rotational speed of the engine **11** may change in the order of, for example, "IDLE" →"IDLE+1" →"IDLE+2".

Fifth Embodiment

[0162] Hereinafter, a fifth embodiment of a ship, a ship controller, a ship control method and a non-transitory computer readable medium of the present invention will be described.

[0163] A ship **1** according to the fifth embodiment is configured in the same manner as the ship **1** according to the first embodiment described above, except for points to be described below. Thus, according to the ship **1** of the fifth embodiment, it is possible to achieve the same effects as those of the ship **1** according to the first embodiment described above, except for points to be described below.

[0164] Similarly, to the ship **1** according to the first embodiment shown in FIG. **1**, the ship **1** according to the fifth embodiment includes, for example, an engine **11**, a jet propulsion device **12**, a ship controller **13**, a ship position detection unit **14**, and an operation unit **15**. A bucket **12**B of the jet propulsion device **12** of the ship **1** according to the fifth embodiment is configured to be able to be disposed at a forward position F, a neutral position N, and a reverse position R.

[0165] A bucket position control unit **13**A of the ship controller **13** of the ship **1** according to the fifth embodiment controls the position of the bucket **12**B (for example, control of disposing the bucket **12**B at the forward position F, control of disposing the bucket **12**B at the neutral position N, control of disposing the bucket **12**B at the reverse position R, and the like).

[0166] An engine rotational speed control unit **13**B of the ship controller **13** of the ship **1** according to the fifth embodiment controls the rotational speed of the engine **11** (that is, control of changing the strength of the jet stream shown in FIG. **2**).

[0167] Similarly, to the ship controller **13** of the ship **1** according to the first embodiment, the ship controller **13** of the ship **1** according to the fifth embodiment not only has the above-mentioned normal mode but also has a ship fixed point holding mode. In the ship fixed point holding mode, the ship controller **13** of the ship **1** according to the fifth embodiment performs feedback control (for example, PID control and the like) of the engine **11** and the jet propulsion device **12** based on a deviation between a target ship position, which is a preset target position of the ship **1**, and the actual ship position.

[0168] In the ship **1** according to the fifth embodiment, when the ship controller **13** is in the ship fixed point holding mode, a forward position F (see FIG. **3**), a neutral position N (see FIGS. **3** and **6**), three forward-side intermediate positions N+1, N+2, and N+3 (see FIG. **3**) located between the forward position F and the neutral position N, a reverse position R (see FIG. **6**), and three reverse-side intermediate positions N−1, N−2, and N−3 (see FIG. **6**) located between the neutral position N and the reverse position R are set as the position of the bucket **12**B that can be disposed by the bucket position control unit **13**A of the ship controller **13**.

[0169] In an example of the ship **1** according to the fifth embodiment (the example shown in FIG. **3**), the three forward-side intermediate positions N+1, N+2, and N+3 are set as a forward-side intermediate position between the neutral position N and the forward position F. However, in another example of the ship **1** according to the fifth embodiment, any number of forward-side intermediate positions other than three may be set as a forward-side intermediate position between the neutral position N and the forward position F.

[0170] In an example of the ship **1** according to the fifth embodiment (the example shown in FIG. **6**), three reverse-side intermediate positions N−1, N−2, and N−3 are set as a reverse-side intermediate position between the neutral position N and the reverse position R. However, in another example of the ship **1** according to the fifth embodiment, any number of reverse-side intermediate positions other than three may be set as a reverse-side intermediate position between the neutral position N and the reverse position R.

[0171] In the ship **1** according to the fifth embodiment, as shown in FIG. **3**, a rotation angle θ of the bucket **12**B required to move the bucket **12**B from the neutral position N to the forward position F is divided into four. A position where the bucket **12**B is rotated by (θ/4) from the neutral position N is set as the forward-side intermediate position N+1, a position where the bucket **12**B is rotated by (2θ/4) from the neutral position N is set as the forward-side intermediate position N+2, and a position where the bucket **12**B is rotated by (3θ/4) from the neutral position N is set as the forward-side intermediate position N+3.

[0172] In the example of the ship **1** according to the fifth embodiment (the example shown in FIG. **3**), the forward-side intermediate positions N+1, N+2, and N+3 are set at the positions obtained by dividing the rotation angle θ of the bucket **12**B required to move the bucket **12**B from the neutral position N to the forward position F at equal angular intervals. However, in another example of the ship **1** according to the fifth embodiment, a rotation angle of the bucket **12**B required to move the bucket **12**B from the neutral position N to the forward-side intermediate position N+1, a rotation angle of the bucket **12**B required to move the bucket **12**B from the forward-side intermediate position N+1 to the forward-side intermediate position N+2, a rotation angle of the bucket **12**B required to move the bucket **12**B from the forward-side intermediate position N+2 to the forward-side intermediate position N+3, and a rotation angle of the bucket **12**B required to move the bucket **12**B from the forward-side intermediate position N+3 to the forward position F may be different from each other.

[0173] In the ship **1** according to the fifth embodiment, as shown in FIG. **6**, a rotation angle θ of the bucket **12**B required to move the bucket **12**B from the neutral position N to the reverse position R is divided into four. A position where the bucket **12**B is rotated by (θ/4) from the neutral position N is set as the reverse-side intermediate position N−1, a position where the bucket **12**B is rotated by (2θ/4) from the neutral position N is set as the reverse-side intermediate position N−2, and a position where the bucket **12**B is rotated by (3θ/4) from the neutral position N is set as the reverse-side intermediate position N−3.

[0174] In the example of the ship **1** according to the fifth embodiment (the example shown in FIG. **6**), the reverse-side intermediate positions N−1, N−2, N−3 are set at the positions obtained by dividing the rotation angle θ of the bucket **12**B required to move the bucket **12**B from the neutral position N to the reverse position R at equal angular intervals. However, in another example of the ship **1** according to the fifth embodiment, a rotation angle of the bucket **12**B required to move the bucket **12**B from the neutral position N to the reverse-side intermediate position N−1, a rotation angle of the bucket **12**B required to move the bucket **12**B from the reverse-side intermediate position N−1 to the reverse-side intermediate position N−2, a rotation angle of the bucket **12**B required to move the bucket **12**B from the reverse-side intermediate position N−2 to the reverse-side intermediate position N−3, and a rotation angle of the bucket **12**B required to move the bucket **12**B from the reverse-side intermediate position N−3 to the reverse position R may be different from each other.

[0175] In the ship **1** according to the fifth embodiment, when the ship controller **13** is in the ship fixed point holding mode, the ship controller **13** performs both control of the position of the bucket **12**B (control of disposing the bucket **12**B at any of the forward position F, the forward-side intermediate positions N+1, N+2, and N+3, the neutral position N, the reverse-side intermediate positions N−1, N−2, and N−3, and the reverse position R) and control of the rotational speed of the engine **11**.

[0176] In detail, when the ship controller **13** is in the ship fixed point holding mode, the ship controller **13** performs control of setting the rotational speed of the engine **11** to a predetermined value so that the ship **1** is held at a fixed point of the target ship position, and setting the position of the bucket **12**B to any of the forward position F, the three forward-side intermediate positions N+1, N+2, and N+3, the neutral position N, the three reverse-side intermediate positions N−1, N−2, and N−3, and the reverse position R.

TABLE 5

Deviation	. . .	−6	−5	−4	−3	−2	−1	0
Control amount	. . .	−6	−5	−4	−3	−2	−1	0
Bucket position	. . .	R	R	R	N − 3	N − 2	N − 1	N
Engine rotational speed	. . .	IDLE + 2	IDLE + 1	IDLE	IDLE	IDLE	IDLE	IDLE
Deviation	+1	+2	+3	+4	+5	+6	. . .	
Control amount	+1	+2	+3	+4	+5	+6	. . .	
Bucket position	N + 1	N + 2	N + 3	F	F	F	. . .	
Engine rotational speed	IDLE	IDLE	IDLE	IDLE	IDLE + 1	IDLE + 2	. . .	

[0177] Table 5 shows an example of a correspondence between the rotational speed of the engine **11**, the position of the bucket **12**B, and the like when the ship controller **13** is in the ship fixed point holding mode.

[0178] In the example shown in Table 5, when a deviation between the target ship position and the actual ship position in the ship fixed point holding mode of the ship controller **13** is "−6" (that is, when the actual ship position deviates from the target ship position to the front side of the ship **1** an amount corresponding to the deviation "−6"), the control amount calculated by the ship controller **13** is "−6". As a result, the bucket position control unit **13**A of the ship controller **13** disposes the bucket **12**B at the reverse position R. The engine rotational speed control unit **13**B of the ship controller **13** controls the rotational speed of the engine **11** to "IDLE+2". Thereby, the jet propulsion device **12** generates a propulsive force for moving the ship **1** backward to reduce the deviation from "−6" to zero, and the ship **1** is held at the target ship position.

[0179] In the example shown in Table 5, when a deviation between the target ship position and the actual ship position in the ship fixed point holding mode of the ship controller **13** is "−5" (that is, the actual ship position deviates from the target ship position to the front side of the ship **1** by an amount corresponding to the deviation "−5"), the control amount calculated by the ship controller **13** is "−5". As a result, the bucket position control unit **13**A of the ship controller **13** disposes the bucket **12**B at the reverse position R. The engine rotational speed control unit **13**B of the ship controller **13** controls the rotational speed of the engine **11** to "IDLE+1". Thereby, the jet propulsion device **12** generates a propulsive force for moving the ship **1** backward to reduce the deviation from "−5" to zero, and the ship **1** is held at the target ship position.

[0180] In the example shown in Table 5, when a deviation between the target ship position and the actual ship position in the ship fixed point holding mode of the ship controller **13** is "−4" (that is, the actual ship position deviates from the target ship position to the front side of the ship **1** by an amount corresponding to the deviation "−4"), the control amount calculated by the ship controller **13** is "−4". As a result, the bucket position control unit **13**A of the ship controller **13** disposes the bucket **12**B at the reverse position R. The engine rotational speed control unit **13**B of the ship controller **13** controls the rotational speed of the engine **11** to "IDLE". Thereby, the jet propulsion device **12** generates a propulsive force for moving the ship **1** backward to reduce the deviation from "−4" to zero, and the ship **1** is held at the target ship position.

[0181] In the example shown in Table 5, when a deviation between the target ship position and the actual ship position in the ship fixed point holding mode of the ship controller **13** is "−3" (that is, the actual ship position deviates from the target ship position to the front side of the ship **1** by an amount corresponding to the deviation "−3"), the control amount calculated by the ship controller **13** is "−3". As a result, the bucket position control unit **13**A of the ship controller **13** disposes the bucket **12**B at the reverse-side intermediate position N−3. The engine rotational speed control unit **13**B of the ship controller **13** controls the rotational speed of the engine **11** to "IDLE". Thereby, the jet propulsion device **12** generates a propulsive force for moving the ship **1** backward to reduce the deviation from "−3" to zero, and the ship **1** is held at the target ship position.

[0182] In the example shown in Table 5, when a deviation between the target ship position and the actual ship position in the ship fixed point holding mode of the ship controller **13** is "−2" (that is, the actual ship position deviates from the target ship position to the front side of the ship **1** by an amount corresponding to the deviation "−2"), the control amount calculated by the ship controller **13** is "−2". As a result, the bucket position control unit **13**A of the ship controller **13** disposes the bucket **12**B at the reverse-side intermediate position N−2. The engine rotational speed control unit **13**B of the ship controller **13** controls the rotational speed of the engine **11** to "IDLE". Thereby, the jet propulsion device **12** generates a propulsive force for moving the ship **1** backward to reduce the deviation from "−2" to zero, and the ship **1** is held at the target ship position.

[0183] In the example shown in Table 5, when a deviation between the target ship position and the actual ship position in the ship fixed point holding mode of the ship controller **13** is "−1" (that is, when the actual ship position deviates from the target ship position to the front side of the ship **1** an amount corresponding to the deviation "−1"), the control amount calculated by the ship controller **13** is "−1". As a result, the bucket position control unit **13**A of the ship controller **13** disposes the bucket **12**B at the reverse-side intermediate position N−1. The engine rotational speed control unit **13**B of the ship controller **13** controls the rotational speed of the engine **11** to "IDLE". Thereby, the jet propulsion device **12** generates a propulsive force for moving the ship **1** backward to reduce the deviation from "−1" to zero, and the ship **1** is held at the target ship position.

[0184] In the example shown in Table 5, when a deviation between the target ship position and the actual ship position in the ship fixed point holding mode of the ship controller **13** is zero, a control amount (feedback control amount) calculated by the ship controller **13** is zero. As a result, the bucket position control unit **13**A of the ship controller **13** disposes the bucket **12**B at the neutral position N. The engine rotational speed control unit **13**B of the ship controller **13** controls the rotational speed of the engine **11** to "IDLE" (the rotational speed of the engine **11** in an idling state). For this reason, the jet propulsion device **12** does not generate a propulsive force for moving the ship **1**, and the ship **1** is held at the target ship position.

[0185] In the example shown in Table 5, when a deviation between the target ship position and the actual ship position in the ship fixed point holding mode of the ship controller **13** is "+1" (that is, when the actual ship position deviates from the target ship position to the rear side of the ship **1** by an amount corresponding to the deviation "+1"), the control amount calculated by the ship controller **13** is "+1". As a result, the bucket position control unit **13**A of the ship controller **13** disposes the bucket **12**B at the forward-side intermediate position N+1. The engine rotational speed control unit **13**B of the ship controller **13** controls the rotational speed of the engine **11** to "IDLE". Thereby, the jet propulsion device **12** generates a propulsive force for moving the ship **1** forward to reduce the deviation from "+1" to zero, and the ship **1** is held at the target ship position.

[0186] In the example shown in Table 5, when a deviation between the target ship position and the actual ship position in the ship fixed point holding mode of the ship controller **13** is "+2" (that is, when the actual ship position deviates from the target ship position to the rear side of the ship **1** by an amount corresponding to the deviation "+2"), the control amount calculated by the ship controller **13** is "+2". As a result, the bucket position control unit **13**A of the ship controller **13** disposes the bucket **12**B at the forward-side intermediate position N+2. The engine rotational speed control unit **13**B of the ship controller **13** controls the rotational speed of the engine **11** to "IDLE". Thereby, the jet propulsion device **12** generates a propulsive force for moving the ship **1** forward to reduce the deviation from "+2" to zero, and the ship **1** is held at the target ship position.

[0187] In the example shown in Table 5, when a deviation between the target ship position and the actual ship position in the ship fixed point holding mode of the ship controller **13** is "+3" (that is, when the actual ship position deviates from the target ship position to the rear side of the ship **1** by an amount corresponding to the deviation "+3"), the control amount calculated by the ship controller **13** is "+3". As a result, the bucket position control unit **13**A of the ship controller **13** disposes the bucket **12**B at the forward-side intermediate position N+3. The engine rotational speed control unit **13**B of the ship controller **13** controls the rotational speed of the engine **11** to "IDLE". Thereby, the jet propulsion device **12** generates a propulsive force for moving the ship **1** forward to reduce the deviation from "+3" to zero, and the ship **1** is held at the target ship position.

[0188] In the example shown in Table 5, when a deviation between the target ship position and the actual ship position in the ship fixed point holding mode of the ship controller **13** is "+4" (that is, when the actual ship position deviates from the target ship position to the rear side of the ship **1** by an amount corresponding to the deviation "+4"), the control amount calculated by the ship controller **13** is "+4". As a result, the bucket position control unit **13**A of the ship controller **13** disposes the bucket **12**B at the forward position F. The engine rotational speed control unit **13**B of the ship controller **13** controls the rotational speed of the engine **11** to "IDLE". Thereby, the jet propulsion device **12** generates a propulsive force for moving the ship **1** forward to reduce the deviation from "+4" to zero, and the ship **1** is held at the target ship position.

[0189] In the example shown in Table 5, when a deviation between the target ship position and the actual ship position in the ship fixed point holding mode of the ship controller **13** is "+5" (that is, when the actual ship position deviates from the target ship position to the rear side of the ship **1** by an amount corresponding to the deviation "+5"), the control amount calculated by the ship controller **13** is "+5". As a result, the bucket position control unit **13**A of the ship controller **13** disposes the bucket **12**B at the forward position F. The engine rotational speed control unit **13**B of the ship controller **13** controls the rotational speed of the engine **11** to "IDLE+1". In detail, the engine rotational speed control unit **13**B controls the rotational speed of the engine **11** to "IDLE+1" even when the throttle operation unit **15**A does not receive an input operation from the ship operator. Thereby, the jet propulsion device **12** generates a propulsive force for moving the ship **1** forward to reduce the deviation from "+5" to zero, and the ship **1** is held at the target ship position.

[0190] In the example shown in Table 5, when a deviation between the target ship position and the actual ship position in the ship fixed point holding mode of the ship controller **13** is "+6" (that is, when the actual ship position deviates from the target ship position to the rear side of the ship **1** by an amount corresponding to the deviation "+6"), the control amount calculated by the ship controller **13** is "+6". As a result, the bucket position control unit **13**A of the ship controller **13** disposes the bucket **12**B at the forward position F. The engine rotational speed control unit **13**B of the ship controller **13** controls the rotational speed of the engine **11** to "IDLE+2". Thereby, the jet propulsion device **12** generates a propulsive force for moving the ship **1** forward to reduce the deviation from "+6" to zero, and the ship **1** is held at the target ship position.

[0191] In the example shown in Table 5, when the actual ship position is located behind the target ship position if the position of the bucket **12**B is set to be the neutral position N in the ship fixed point holding mode of the ship controller **13**, and when the actual ship position is located ahead of the target ship position (that is, when a relatively small backward external force is applied to the ship **1**) if the position of the bucket **12**B is set to be the forward position F, the position of the bucket **12**B is set to be, for example, the forward-side intermediate position N+1, the forward-side intermediate position N+2, the forward-side intermediate position N+3, and the like, and the rotational speed of the engine **11** is set to "IDLE" so that the ship **1** is held at a fixed point of the target ship position.

[0192] In the example shown in Table 5, when the actual ship position is located ahead of the target ship position if the position of the bucket **12**B is set to be the neutral position N in the ship fixed point holding mode of the ship controller **13**, and when the actual ship position is located behind the target ship position (that is, when a relatively small forward external force is applied to the ship **1**) if the position of the bucket **12**B is set to be the reverse position R, the position of the bucket **12**B is set to be, for example, the reverse-side intermediate position N−1, the reverse-side intermediate position N−2, the reverse-side intermediate position N−3, and the like, and the rotational speed of the engine **11** is set to "IDLE" so that the ship **1** is held at a fixed point of the target ship position.

[0193] That is, in the example shown in Table 5, the forward side intermediate positions N+1, N+2, and N+3 and the reverse-side intermediate positions N−1, N−2, and N−3 are set as the position of the bucket **12**B, and both the control of the position of the bucket **12**B and control of the rotational speed of the engine **11** are performed when the ship

controller **13** is in the ship fixed point holding mode. Thus, for example, when a deviation between the target ship position and the actual ship position is "+1", "+2", or "+3", it is possible to prevent the ship **1** from excessively moving ahead of the target ship position due to the bucket **12**B being disposed at the forward position F, and for example, when a deviation between the target ship position and the actual ship position is "−1", "−2", or "−3", it is possible to prevent the ship **1** from excessively moving to the rear side of the target ship position due to the bucket **12**B being disposed at the reverse position R.

[0194] That is, in the ship **1** according to the fifth embodiment, it is possible to improve controllability of ship fixed point holding as compared to when the forward-side intermediate positions N+1, N+2, and N+3 are not set as the position of the bucket **12**B, when the reverse-side intermediate positions N−1, N−2, and N−3 are not set as the position of the bucket **12**B, and when both the control of the position of the bucket **12**B and the control of the rotational speed of the engine **11** are not performed in the ship fixed point holding mode of the ship controller **13**.

[0195] In the example shown in Table 5, the rotational speed of the engine **11** is controlled to "IDLE" when the position of the bucket **12**B is set to be the forward-side intermediate positions N+1, N+2, and N+3. However, in another example, when the position of the bucket **12**B is set to be the forward-side intermediate positions N+1, N+2, and N+3, the rotational speed of the engine **11** may be controlled to a rotational speed (for example, "IDLE+1", "IDLE+2", or the like) other than "IDLE". Specifically, when the position of the bucket **12**B changes in the order of the forward-side intermediate position N+1→the forward-side intermediate position N+2→the forward-side intermediate position N+3, the rotational speed of the engine **11** may change in the order of, for example, "IDLE" →"IDLE+1" →"IDLE+2".

[0196] In the example shown in Table 5, the rotational speed of the engine **11** is controlled to "IDLE" when the position of the bucket **12**B is set to be the reverse-side intermediate positions N−1, N−2, and N−3. However, in another example, when the position of the bucket **12**B is set to be the reverse-side intermediate positions N−1, N−2, and N−3, the rotational speed of the engine **11** may be controlled to a rotational speed (for example, "IDLE+1", "IDLE+2", or the like) other than "IDLE". Specifically, when the position of the bucket **12**B changes in the order of the reverse-side intermediate position N−1→the reverse-side intermediate position N−2→the reverse-side intermediate position N−3, the rotational speed of the engine **11** may change in the order of, for example, "IDLE" →"IDLE+1" →"IDLE+2".

[0197] FIG. **9** is a flowchart showing an example of processing performed by the ship controller **13** of the ship **1** according to the fifth embodiment.

[0198] In the example shown in FIG. **9**, in step S**50**, the ship controller **13** determines whether it is a ship fixed point holding mode (determines whether it is a ship fixed point holding mode or a normal mode). When the ship controller **13** is in the ship fixed point holding mode, the processing proceeds to step S**51**, and when the ship controller **13** is in the normal mode, the processing proceeds to step S**52**.

[0199] In step S**51**, the ship controller **13** performs feedback control of the engine **11** and jet propulsion device **12** based on a deviation between the target ship position and the actual ship position. In detail, the ship controller **13** performs control of holding the ship **1** at the target ship position (performs fixed point holding of the ship **1**).

[0200] Specifically, in step S**51**A, the bucket position control unit **13**A of the ship controller **13** controls the position of the bucket **12**B. In the above-described example shown in Table 5, the position of the bucket **12**B includes the forward position F, the forward-side intermediate positions N+1, N+2, and N+3, the neutral position N, the reverse position R, and the reverse-side intermediate positions N−1, N−2, and N−3.

[0201] In step S**51**B, the engine rotational speed control unit **13**B of the ship controller **13** controls the rotational speed of the engine **11**.

[0202] That is, when step S**51** is performed, both the control of the position of the bucket **12**B including the forward-side intermediate positions N+1, N+2, and N+3 and the reverse-side intermediate positions N−1, N−2, and N−3 and the control of the rotational speed of the engine **11** are performed.

[0203] In step S**52**, the ship controller **13** controls the normal mode. Specifically, the bucket position control unit **13**A controls the position of the bucket **12**B to any of the forward position F, the neutral position N, and the reverse position R based on the ship operator's input operation received by the shift operation unit **15**B. The engine rotational speed control unit **13**B controls the rotational speed of the engine **11** based on the ship operator's input operation received by the throttle operation unit **15**A.

Sixth Embodiment

[0204] Hereinafter, a sixth embodiment of a ship, a ship controller, a ship control method and a non-transitory computer readable medium of the present invention will be described.

[0205] A ship **1** according to the sixth embodiment is configured in the same manner as the ship **1** according to the first embodiment described above, except for points to be described below. Thus, according to the ship **1** of the sixth embodiment, it is possible to achieve the same effects as those of the ship **1** according to the first embodiment described above, except for points to be described below.

[0206] Similarly, to the ship **1** according to the first embodiment shown in FIG. **1**, the ship **1** according to the sixth embodiment includes, for example, an engine **11**, a jet propulsion device **12**, a ship controller **13**, a ship position detection unit **14**, and an operation unit **15**. A bucket **12**B of the jet propulsion device **12** of the ship **1** according to the sixth embodiment is configured to be able to be disposed at a forward position F, a neutral position N, and a reverse position R.

[0207] A bucket position control unit **13**A of the ship controller **13** of the ship **1** according to the sixth embodiment controls the position of the bucket **12**B (for example, control of disposing the bucket **12**B at the forward position F, control of disposing the bucket **12**B at the neutral position N, control of disposing the bucket **12**B at the reverse position R, and the like).

[0208] An engine rotational speed control unit **13**B of the ship controller **13** of the ship **1** according to the sixth embodiment controls the rotational speed of the engine **11** (that is, control of changing the strength of the jet stream shown in FIG. **2**).

[0209] Similarly, to the ship controller **13** of the ship **1** according to the first embodiment, the ship controller **13** of

the ship **1** according to the sixth embodiment not only has the above-mentioned normal mode but also has a ship fixed point holding mode. In the ship fixed point holding mode, the ship controller **13** of the ship **1** according to the sixth embodiment performs feedback control (for example, PID control and the like) of the engine **11** and the jet propulsion device **12** based on a deviation between a target ship position, which is a preset target position of the ship **1**, and the actual ship position.

[0210] In the ship **1** according to the sixth embodiment, when the ship controller **13** is in the ship fixed point holding mode, a forward position F (see FIG. **5**), a neutral position N (see FIGS. **5** and **8**), a linear forward-side intermediate position NF (see FIG. **5**) that can be linearly adjusted between the forward position F and the neutral position N, a reverse position R (see FIG. **8**), and a linear reverse-side intermediate position NR (see FIG. **8**) that can be linearly adjusted between the neutral position N and the reverse position R are set as the position of the bucket **12**B that can be disposed by the bucket position control unit **13**A of the ship controller **13**.

[0211] That is, the position of the bucket **12**B that can be disposed by the bucket position control unit **13**A in the ship fixed point holding mode of the ship controller **13** includes the forward position F, the neutral position N, the linear forward-side intermediate position NF therebetween, the reverse position R, and the linear reverse-side intermediate position NR between the neutral position N and the reverse position R.

[0212] In the ship **1** according to the sixth embodiment, when the ship controller **13** is in the ship fixed point holding mode, the ship controller **13** performs both control of the position of the bucket **12**B (control of disposing the bucket **12**B at any of the forward position F, the linear forward-side intermediate position NF, the neutral position N, the linear reverse-side intermediate position NR, and the reverse position R) and control of the rotational speed of the engine **11**.

[0213] In detail, when the ship controller **13** is in the ship fixed point holding mode, the ship controller **13** performs control of setting the rotational speed of the engine **11** to a predetermined value so that the ship **1** is held at a fixed point of the target ship position, and setting the position of the bucket **12**B to any of the forward position F, the linear forward-side intermediate position NF, the neutral position N, the linear reverse-side intermediate position NR, and the reverse position R.

TABLE 6

Deviation	. . .	−6	−5	−4	−3	−2	−1	0
Control amount	. . .	−6	−5	−4	−3	−2	−1	0
Bucket position	. . .	R	R	R	NR	NR	NR	N
Engine rotational speed	. . .	IDLE + 2	IDLE + 1	IDLE	IDLE	IDLE	IDLE	IDLE
Deviation	+1	+2	+3	+4	+5	+6	. . .	
Control amount	+1	+2	+3	+4	+5	+6	. . .	
Bucket position	NF	NF	NF	F	F	F	. . .	
Engine rotational speed	IDLE	IDLE	IDLE	IDLE	IDLE + 1	IDLE + 2	. . .	

[0214] Table 6 shows an example of a correspondence between the rotational speed of the engine **11**, the position of the bucket **12**B, and the like when the ship controller **13** of the ship **1** according to the sixth embodiment is in the ship fixed point holding mode.

[0215] In the example shown in Table 6, when a deviation between the target ship position and the actual ship position in the ship fixed point holding mode of the ship controller **13** is "−6" (that is, when the actual ship position deviates from the target ship position to the front side of the ship **1** an amount corresponding to the deviation "−6"), the control amount (feedback control amount) calculated by the ship controller **13** is "−6". As a result, the bucket position control unit **13**A of the ship controller **13** disposes the bucket **12**B at the reverse position R. The engine rotational speed control unit **13**B of the ship controller **13** controls the rotational speed of the engine **11** to "IDLE+2". Thereby, the jet propulsion device **12** generates a propulsive force for moving the ship **1** backward to reduce the deviation from "−6" to zero, and the ship **1** is held at the target ship position.

[0216] In the example shown in Table 6, when a deviation between the target ship position and the actual ship position in the ship fixed point holding mode of the ship controller **13** is "−5" (that is, the actual ship position deviates from the target ship position to the front side of the ship **1** by an amount corresponding to the deviation "−5"), the control amount calculated by the ship controller **13** is "−5". As a result, the bucket position control unit **13**A of the ship controller **13** disposes the bucket **12**B at the reverse position R. The engine rotational speed control unit **13**B of the ship controller **13** controls the rotational speed of the engine **11** to "IDLE+1". Thereby, the jet propulsion device **12** generates a propulsive force for moving the ship **1** forward to reduce the deviation from "−5" to zero, and the ship **1** is held at the target ship position.

[0217] In the example shown in Table 6, when a deviation between the target ship position and the actual ship position in the ship fixed point holding mode of the ship controller **13** is "−4" (that is, the actual ship position deviates from the target ship position to the front side of the ship **1** by an amount corresponding to the deviation "−4"), the control amount calculated by the ship controller **13** is "−4". As a result, the bucket position control unit **13**A of the ship controller **13** disposes the bucket **12**B at the reverse position R. The engine rotational speed control unit **13**B of the ship controller **13** controls the rotational speed of the engine **11** to "IDLE". Thereby, the jet propulsion device **12** generates a propulsive force for moving the ship **1** backward to reduce the deviation from "−4" to zero, and the ship **1** is held at the target ship position.

[0218] In the example shown in Table 6, when a deviation between the target ship position and the actual ship position in the ship fixed point holding mode of the ship controller **13** is "−3" (that is, the actual ship position deviates from the target ship position to the front side of the ship **1** by an amount corresponding to the deviation "−3"), the control amount calculated by the ship controller **13** is "−3". As a result, the bucket position control unit **13**A of the ship controller **13** disposes the bucket **12**B at the linear reverse-side intermediate position NR. In detail, the bucket position

control unit **13**A adjusts the position of the bucket **12**B to a position close to the reverse position R at the linear reverse-side intermediate position NR. The engine rotational speed control unit **13**B of the ship controller **13** controls the rotational speed of the engine **11** to "IDLE". Thereby, the jet propulsion device **12** generates a propulsive force for moving the ship **1** backward to reduce the deviation from "−3" to zero, and the ship **1** is held at the target ship position.

[0219] In the example shown in Table 6, when a deviation between the target ship position and the actual ship position in the ship fixed point holding mode of the ship controller **13** is "−2" (that is, the actual ship position deviates from the target ship position to the front side of the ship **1** by an amount corresponding to the deviation "−2"), the control amount calculated by the ship controller **13** is "−2". As a result, the bucket position control unit **13**A of the ship controller **13** disposes the bucket **12**B at the linear reverse-side intermediate position NR. In detail, the bucket position control unit **13**A adjusts the position of the bucket **12**B to a position between the neutral position N at the linear reverse-side intermediate position NR and the reverse position R. The engine rotational speed control unit **13**B of the ship controller **13** controls the rotational speed of the engine **11** to "IDLE". Thereby, the jet propulsion device **12** generates a propulsive force for moving the ship **1** backward to reduce the deviation from "−2" to zero, and the ship **1** is held at the target ship position.

[0220] In the example shown in Table 6, when a deviation between the target ship position and the actual ship position in the ship fixed point holding mode of the ship controller **13** is "−1" (that is, when the actual ship position deviates from the target ship position to the front side of the ship **1** an amount corresponding to the deviation "−1"), the control amount calculated by the ship controller **13** is "−1". As a result, the bucket position control unit **13**A of the ship controller **13** disposes the bucket **12**B at the linear reverse-side intermediate position NR. In detail, the bucket position control unit **13**A adjusts the position of the bucket **12**B to a position close to the neutral position N at the linear reverse-side intermediate position NR. The engine rotational speed control unit **13**B of the ship controller **13** controls the rotational speed of the engine **11** to "IDLE". Thereby, the jet propulsion device **12** generates a propulsive force for moving the ship **1** backward to reduce the deviation from "−1" to zero, and the ship **1** is held at the target ship position.

[0221] In the example shown in Table 6, when a deviation between the target ship position and the actual ship position in the ship fixed point holding mode of the ship controller **13** is zero, a control amount calculated by the ship controller **13** is zero. As a result, the bucket position control unit **13**A of the ship controller **13** disposes the bucket **12**B at the neutral position N. The engine rotational speed control unit **13**B of the ship controller **13** controls the rotational speed of the engine **11** to "IDLE". For this reason, the jet propulsion device **12** does not generate a propulsive force for moving the ship **1**, and the ship **1** is held at the target ship position.

[0222] In the example shown in Table 6, when a deviation between the target ship position and the actual ship position in the ship fixed point holding mode of the ship controller **13** is "+1" (that is, when the actual ship position deviates from the target ship position to the rear side of the ship **1** by an amount corresponding to the deviation "+1"), the control amount calculated by the ship controller **13** is "+1". As a result, the bucket position control unit **13**A of the ship controller **13** disposes the bucket **12**B at the linear forward-side intermediate position NF. In detail, the bucket position control unit **13**A adjusts the position of the bucket **12**B to a position close to the neutral position N at the linear forward-side intermediate position NF. The engine rotational speed control unit **13**B of the ship controller **13** controls the rotational speed of the engine **11** to "IDLE". Thereby, the jet propulsion device **12** generates a propulsive force for moving the ship **1** forward to reduce the deviation from "+1" to zero, and the ship **1** is held at the target ship position.

[0223] In the example shown in Table 6, when a deviation between the target ship position and the actual ship position in the ship fixed point holding mode of the ship controller **13** is "+2" (that is, when the actual ship position deviates from the target ship position to the rear side of the ship **1** by an amount corresponding to the deviation "+2"), the control amount calculated by the ship controller **13** is "+2". As a result, the bucket position control unit **13**A of the ship controller **13** disposes the bucket **12**B at the linear forward-side intermediate position NF. In detail, the bucket position control unit **13**A adjusts the position of the bucket **12**B to a position between the neutral position N at the linear forward-side intermediate positions NF and the forward position F. The engine rotational speed control unit **13**B of the ship controller **13** controls the rotational speed of the engine **11** to "IDLE". Thereby, the jet propulsion device **12** generates a propulsive force for moving the ship **1** forward to reduce the deviation from "+2" to zero, and the ship **1** is held at the target ship position.

[0224] In the example shown in Table 6, when a deviation between the target ship position and the actual ship position in the ship fixed point holding mode of the ship controller **13** is "+3" (that is, when the actual ship position deviates from the target ship position to the rear side of the ship **1** by an amount corresponding to the deviation "+3"), the control amount calculated by the ship controller **13** is "+3". As a result, the bucket position control unit **13**A of the ship controller **13** disposes the bucket **12**B at the linear forward-side intermediate position NF. In detail, the bucket position control unit **13**A adjusts the position of the bucket **12**B to a position close to the forward position F at the linear forward-side intermediate position NF. The engine rotational speed control unit **13**B of the ship controller **13** controls the rotational speed of the engine **11** to "IDLE". Thereby, the jet propulsion device **12** generates a propulsive force for moving the ship **1** forward to reduce the deviation from "+3" to zero, and the ship **1** is held at the target ship position.

[0225] In the example shown in Table 6, when a deviation between the target ship position and the actual ship position in the ship fixed point holding mode of the ship controller **13** is "+4" (that is, when the actual ship position deviates from the target ship position to the rear side of the ship **1** by an amount corresponding to the deviation "+4"), the control amount calculated by the ship controller **13** is "+4". As a result, the bucket position control unit **13**A of the ship controller **13** disposes the bucket **12**B at the forward position F. The engine rotational speed control unit **13**B of the ship controller **13** controls the rotational speed of the engine **11** to "IDLE". Thereby, the jet propulsion device **12** generates a propulsive force for moving the ship **1** forward to reduce the deviation from "+4" to zero, and the ship **1** is held at the target ship position.

[0226] In the example shown in Table 6, when a deviation between the target ship position and the actual ship position

in the ship fixed point holding mode of the ship controller **13** is "+5" (that is, when the actual ship position deviates from the target ship position to the rear side of the ship **1** by an amount corresponding to the deviation "+5"), the control amount calculated by the ship controller **13** is "+5". As a result, the bucket position control unit **13**A of the ship controller **13** disposes the bucket **12**B at the forward position F. The engine rotational speed control unit **13**B of the ship controller **13** controls the rotational speed of the engine **11** to "IDLE+1". Thereby, the jet propulsion device **12** generates a propulsive force for moving the ship **1** forward to reduce the deviation from "+5" to zero, and the ship **1** is held at the target ship position.

[0227] In the example shown in Table 6, when a deviation between the target ship position and the actual ship position in the ship fixed point holding mode of the ship controller **13** is "+6" (that is, when the actual ship position deviates from the target ship position to the rear side of the ship **1** by an amount corresponding to the deviation "+6"), the control amount calculated by the ship controller **13** is "+6". As a result, the bucket position control unit **13**A of the ship controller **13** disposes the bucket **12**B at the forward position F. The engine rotational speed control unit **13**B of the ship controller **13** controls the rotational speed of the engine **11** to "IDLE+2". Thereby, the jet propulsion device **12** generates a propulsive force for moving the ship **1** forward to reduce the deviation from "+6" to zero, and the ship **1** is held at the target ship position.

[0228] In the example shown in Table 6, when the actual ship position is located behind the target ship position if the position of the bucket **12**B is set to be the neutral position N in the ship fixed point holding mode of the ship controller **13**, and when the actual ship position is located ahead of the target ship position (that is, when a relatively small backward external force is applied to the ship **1**) if the position of the bucket **12**B is set to be the forward position F, the position of the bucket **12**B is set to be the linear forward-side intermediate position NF, and the rotational speed of the engine **11** is set to "IDLE" so that the ship **1** is held at a fixed point of the target ship position.

[0229] In the example shown in Table 6, when the actual ship position is located ahead of the target ship position if the position of the bucket **12**B is set to be the neutral position N in the ship fixed point holding mode of the ship controller **13**, and when the actual ship position is located behind the target ship position (that is, when a relatively small forward external force is applied to the ship **1**) if the position of the bucket **12**B is set to be the reverse position R, the position of the bucket **12**B is set to be the linear reverse-side intermediate position NR, and the rotational speed of the engine **11** is set to "IDLE" so that the ship **1** is held at a fixed point of the target ship position.

[0230] That is, in the example shown in Table 6, the linear forward-side intermediate position NF and the linear reverse-side intermediate position NR are set as the position of the bucket **12**B, and both the control of the position of the bucket **12**B and control of the rotational speed of the engine **11** are performed when the ship controller **13** is in the ship fixed point holding mode. Thus, for example, when a deviation between the target ship position and the actual ship position is "+1", "+2", or "+3", it is possible to prevent the ship **1** from excessively moving ahead of the target ship position due to the bucket **12**B being disposed at the forward position F, and for example, when a deviation between the target ship position and the actual ship position is "−1", "−2", or "−3", it is possible to prevent the ship **1** from excessively moving to the rear side of the target ship position due to the bucket **12**B being disposed at the reverse position R.

[0231] That is, in the ship **1** according to the sixth embodiment, it is possible to improve controllability of ship fixed point holding as compared to when the linear forward-side intermediate position NF is not set as the position of the bucket **12**B, when the linear reverse-side intermediate position NR is not set as the position of the bucket **12**B, and when both the control of the position of the bucket **12**B and the control of the rotational speed of the engine **11** are not performed in the ship fixed point holding mode of the ship controller **13**.

[0232] In the example shown in Table 6, the rotational speed of the engine **11** is controlled to "IDLE" when the position of the bucket **12**B is set to be the linear forward-side intermediate position NF. However, in another example, the position of the bucket **12**B is set to be the linear forward-side intermediate position NF, the rotational speed of the engine **11** may be controlled to a rotational speed (for example, "IDLE+1", "IDLE+2", or the like) other than "IDLE". Specifically, when the position of the bucket **12**B changes in the order of a position close to the neutral position N at the linear forward-side intermediate positions NF→a position between the neutral position N at the linear forward-side intermediate positions NF and the forward position F→a position close to the forward position F at the linear forward-side intermediate position NF, the rotational speed of the engine **11** may change in the order of, for example, "IDLE" →"IDLE+1" →"IDLE+2".

[0233] In the example shown in Table 6, the rotational speed of the engine **11** is controlled to "IDLE" when the position of the bucket **12**B is set to be the linear reverse-side intermediate position NR. However, in another example, when the position of the bucket **12**B is set to be the linear reverse-side intermediate position NR, the rotational speed of the engine **11** may be controlled to a rotational speed (for example, "IDLE+1" "IDLE+2", or the like) other than "IDLE". Specifically, when the position of the bucket **12**B changes in the order of a position close to the neutral position N at the linear reverse-side intermediate positions NR→a position between the neutral position N at the linear reverse-side intermediate positions NR and the reverse position R→a position close to the reverse position R at the linear reverse-side intermediate position NR, the rotational speed of the engine **11** may change in the order of, for example, "IDLE" →"IDLE+1" →"IDLE+2".

Seventh Embodiment

[0234] Hereinafter, a seventh embodiment of a ship, a ship controller, a ship control method and a non-transitory computer readable medium of the present invention will be described.

[0235] A ship **1** according to the seventh embodiment is configured in the same manner as the ships **1** according to the first to sixth embodiments described above, except for points to be described below. Thus, according to the ship **1** of the seventh embodiment, it is possible to achieve the same effects as those of the ships **1** according to the first to sixth embodiments described above, except for points to be described below.

[0236] As described above, the ships **1** according to the first to sixth embodiments are PWCs, but the ship **1** according to the seventh embodiment is, for example, a ship having the same basic configuration of a sports boat described in FIG. 1 of Japanese Unexamined Patent Application, First Publication No. 2020-019321.

[0237] FIGS. **10**A to **12** are diagrams showing examples of control that can be performed in the ships **1** according to the first to seventh embodiments. In detail, FIG. **10**A shows a relationship between a ship, a holding OK area, and the like when control of holding the ship in the holding OK area is started. FIG. **10**B shows a relationship between a ship, a holding OK area, and the like when a ship position changes due to a disturbance. FIG. **11**A shows turning-round of a ship whose ship position has changed due to a disturbance, with the stem of the ship being directed toward target coordinates. FIG. **11**B shows a state where the ship position of the ship whose stem is directed toward the target coordinates changes again due to a disturbance. FIG. **12** shows a state where throttle control (recurrence control) is performed until the ship enters the holding OK area.

[0238] In the examples shown in FIGS. **10**A to **12**, when the ship controllers **13** of the ships **1** according to the first to seventh embodiments are in the ship fixed point holding mode, "target coordinates", a "holding OK area" including the "target coordinates", an "orientation control area" around the "holding OK area", and a "recurrence control area" around the "orientation control area" are set.

[0239] In detail, in the examples shown in FIGS. **10**A to **12**, as shown in FIG. **10**A, coordinates indicating the position of the ship at the start of control of holding the ship in the holding OK area are set as "target coordinates."

[0240] As shown in FIG. **10**B, when the ship moves from the "holding OK area" to the "orientation control area" due to a disturbance, turning-round of the ship is performed such that the stem of the ship is directed toward the "target coordinates" as shown in FIG. **11**A. In another example, turning-round of the ship may be performed such that the stem of the ship is directed toward the "target coordinates."

[0241] As shown in FIG. **11**B, when the ship moves from the "orientation control area" to the "recurrence control area" due to a disturbance, throttle control of causing the ship to enter the "holding OK area" (recurrence control) is performed as shown in FIG. **12**.

[0242] FIGS. **13**A to **15** are diagrams showing other examples of control that can be performed in the ships **1** according to the first to seventh embodiments. In detail, FIG. **13**A shows a relationship between a ship, a holding OK area, and the like when control of holding the ship in the holding OK area is started. FIG. **13**B shows a relationship between a ship, a holding OK area, and the like when a ship position changes due to a disturbance. FIG. **14**A shows turning-round of a ship whose ship position has changed due to a disturbance, with the stern of the ship being directed toward target coordinates. FIG. **14**B shows a state where the ship position of the ship whose stern is directed toward the target coordinates changes again due to a disturbance. FIG. **15** shows a state where throttle control (recurrence control) is performed until the ship enters the holding OK area.

[0243] In the examples shown in FIG. **13**A to FIG. **15**, when the ship controllers **13** of the ships **1** according to the first to seventh embodiments are in the ship fixed point holding mode, "target coordinates", a "holding OK area" including the "target coordinates", and a "recurrence control area" around the "holding OK area" are set.

[0244] In detail, in the examples shown in FIGS. **13**A to **15**, as shown in FIG. **13**A, coordinates indicating the position of the ship at the start of control of holding the ship in the holding OK area are set as "target coordinates."

[0245] As shown in FIG. **13**B, when the position of the ship deviates from the "target coordinates" due to a disturbance, turning-round of the ship is performed such that the stern of the ship is directed toward the "target coordinates" as shown in FIG. **14**A even when the position of the ship is within the "holding OK area". In another example, turning-round of the ship may be performed such that the stem of the ship is directed toward the "target coordinates."

[0246] As shown in FIG. **14**B, when the ship moves to the "recurrence control area" due to a disturbance, throttle control (recurrence control) of causing the ship to enter the "holding OK area" is performed as shown in FIG. **15**.

[0247] Although a mode for implementing the present invention has been described above using the embodiments, the present invention is not limited to these embodiments, and various modifications and substitutions can be added without departing from the gist of the present invention. The configurations described in the embodiments and examples described above may be combined.

[0248] An aspect of the present invention is a ship controller included in a ship that includes an engine that outputs a driving force, a jet propulsion device that generates a propulsion force of the ship using the driving force output from the engine, and a ship position detection unit that detects an actual ship position which is an actual position of the ship, in which the jet propulsion device includes a nozzle that ejects a jet stream generated by the driving force output from the engine, and a bucket that changes a direction of the jet stream ejected from the nozzle, the position of the bucket includes at least a forward position where the jet propulsion device generates a propulsive force for moving the ship forward, a neutral position where the jet propulsion device does not generate a propulsive force for moving the ship, and a forward-side intermediate position between the forward position and the neutral position, and the ship controller has a ship fixed point holding mode in which feedback control of the engine and the jet propulsion device is performed based on a deviation between a target ship position, which is a preset target position of the ship, and the actual ship position, and performs both control of the position of the bucket including the forward-side intermediate position and control of a rotational speed of the engine in the ship fixed point holding mode.

[0249] An aspect of the present invention is a ship controller included in a ship that includes an engine that outputs a driving force, a jet propulsion device that generates a propulsion force of the ship using the driving force output from the engine, and a ship position detection unit that detects an actual ship position which is an actual position of the ship, in which the jet propulsion device includes a nozzle that ejects a jet stream generated by the driving force output from the engine, and a bucket that changes a direction of the jet stream ejected from the nozzle, the position of the bucket includes at least a forward position where the jet propulsion device generates a propulsive force for moving the ship forward, a neutral position where the jet propulsion device does not generate a propulsive force for moving the ship, a reverse position where the jet propulsion device generates a

propulsive force for moving the ship backward, and a reverse-side intermediate position between the reverse position and the neutral position, and the ship controller has a ship fixed point holding mode in which feedback control of the engine and the jet propulsion device is performed based on a deviation between a target ship position, which is a preset target position of the ship, and the actual ship position, and performs both control of the position of the bucket including the reverse-side intermediate position and control of a rotational speed of the engine in the ship fixed point holding mode.

[0250] An aspect of the present invention is a ship controller included in a ship that includes an engine that outputs a driving force, a jet propulsion device that generates a propulsion force of the ship using the driving force output from the engine, and a ship position detection unit that detects an actual ship position which is an actual position of the ship, in which the jet propulsion device includes a nozzle that ejects a jet stream generated by the driving force output from the engine, and a bucket that changes a direction of the jet stream ejected from the nozzle, the position of the bucket includes at least a forward position where the jet propulsion device generates a propulsive force for moving the ship forward, a neutral position where the jet propulsion device does not generate a propulsive force for moving the ship, a reverse position where the jet propulsion device generates a propulsive force for moving the ship backward, a forward-side intermediate position between the forward position and the neutral position, and a reverse-side intermediate position between the reverse position and the neutral position, and the ship controller has a ship fixed point holding mode in which feedback control of the engine and the jet propulsion device is performed based on a deviation between a target ship position, which is a preset target position of the ship, and the actual ship position, and performs control of the position of the bucket including the forward-side intermediate position and the reverse-side intermediate position and control of a rotational speed of the engine in the ship fixed point holding mode.

[0251] An aspect of the present invention is a ship control method of controlling a ship that includes an engine that outputs a driving force, a jet propulsion device that generates a propulsion force of the ship using the driving force output from the engine, and a ship position detection unit that detects an actual ship position which is an actual position of the ship, in which the jet propulsion device includes a nozzle that ejects a jet stream generated by the driving force output from the engine, and a bucket that changes a direction of the jet stream ejected from the nozzle, the position of the bucket includes at least a forward position where the jet propulsion device generates a propulsive force for moving the ship forward, a neutral position where the jet propulsion device does not generate a propulsive force for moving the ship, and a forward-side intermediate position between the forward position and the neutral position, the ship control method includes performing feedback control of the engine and the jet propulsion device based on a deviation between a target ship position, which is a preset target position of the ship, and the actual ship position, and both control of the position of the bucket including the forward-side intermediate position and control of a rotational speed of the engine are performed when the feedback control is performed.

[0252] An aspect of the present invention is a ship control method of controlling a ship that includes an engine that outputs a driving force, a jet propulsion device that generates a propulsion force of the ship using the driving force output from the engine, and a ship position detection unit that detects an actual ship position which is an actual position of the ship, in which the jet propulsion device includes a nozzle that ejects a jet stream generated by the driving force output from the engine, and a bucket that changes a direction of the jet stream ejected from the nozzle, the position of the bucket includes at least a forward position where the jet propulsion device generates a propulsive force for moving the ship forward, a neutral position where the jet propulsion device does not generate a propulsive force for moving the ship, a reverse position where the jet propulsion device generates a propulsive force for moving the ship backward, and a reverse-side intermediate position between the reverse position and the neutral position, the ship control method includes performing feedback control of the engine and the jet propulsion device based on a deviation between a target ship position, which is a preset target position of the ship, and the actual ship position, and both control of the position of the bucket including the reverse-side intermediate position and control of a rotational speed of the engine are performed when the feedback control is performed.

[0253] An aspect of the present invention is a ship control method of controlling a ship that includes an engine that outputs a driving force, a jet propulsion device that generates a propulsion force of the ship using the driving force output from the engine, and a ship position detection unit that detects an actual ship position which is an actual position of the ship, in which the jet propulsion device includes a nozzle that ejects a jet stream generated by the driving force output from the engine, and a bucket that changes a direction of the jet stream ejected from the nozzle, the position of the bucket includes at least a forward position where the jet propulsion device generates a propulsive force for moving the ship forward, a neutral position where the jet propulsion device does not generate a propulsive force for moving the ship, a reverse position where the jet propulsion device generates a propulsive force for moving the ship backward, a forward-side intermediate position between the forward position and the neutral position, and a reverse-side intermediate position between the reverse position and the neutral position, the ship control method includes performing feedback control of the engine and the jet propulsion device based on a deviation between a target ship position, which is a preset target position of the ship, and the actual ship position, and both control of the position of the bucket including the forward-side intermediate position and the reverse-side intermediate position and control of a rotational speed of the engine are performed when the feedback control is performed.

[0254] An aspect of the present invention is a non-transitory computer readable medium causing a computer mounted on a ship to perform feedback control of an engine and a jet propulsion device based on a deviation between a target ship position, which is a preset target position of the ship, and an actual ship position, the ship including the engine that outputs a driving force, the jet propulsion device that generates a propulsion force of the ship using the driving force output from the engine, and a ship position detection unit that detects the actual ship position which is an actual position of the ship, in which the jet propulsion device includes a nozzle that ejects a jet stream generated by the driving force output from the engine, and a bucket that changes a direction of the jet stream ejected from the nozzle,

the position of the bucket includes at least a forward position where the jet propulsion device generates a propulsive force for moving the ship forward, a neutral position where the jet propulsion device does not generate a propulsive force for moving the ship, and a forward-side intermediate position between the forward position and the neutral position, and both control of the position of the bucket including the forward-side intermediate position and control of a rotational speed of the engine are performed when the feedback control is performed.

[0255] An aspect of the present invention is a non-transitory computer readable medium causing a computer mounted on a ship to perform feedback control of an engine and a jet propulsion device based on a deviation between a target ship position, which is a preset target position of the ship, and an actual ship position, the ship including the engine that outputs a driving force, the jet propulsion device that generates a propulsion force of the ship using the driving force output from the engine, and a ship position detection unit that detects the actual ship position which is an actual position of the ship, in which the jet propulsion device includes a nozzle that ejects a jet stream generated by the driving force output from the engine, and a bucket that changes a direction of the jet stream ejected from the nozzle, the position of the bucket includes at least a forward position where the jet propulsion device generates a propulsive force for moving the ship forward, a neutral position where the jet propulsion device does not generate a propulsive force for moving the ship, a reverse position where the jet propulsion device generates a propulsive force for moving the ship backward, and a reverse-side intermediate position between the reverse position and the neutral position, and both control of the position of the bucket including the reverse-side intermediate position and control of a rotational speed of the engine are performed when the feedback control is performed.

[0256] An aspect of the present invention is a non-transitory computer readable medium causing a computer mounted on a ship to perform feedback control of an engine and a jet propulsion device based on a deviation between a target ship position, which is a preset target position of the ship, and an actual ship position, the ship including the engine that outputs a driving force, the jet propulsion device that generates a propulsion force of the ship using the driving force output from the engine, and a ship position detection unit that detects the actual ship position which is an actual position of the ship, in which the jet propulsion device includes a nozzle that ejects a jet stream generated by the driving force output from the engine, and a bucket that changes a direction of the jet stream ejected from the nozzle, the position of the bucket includes at least a forward position where the jet propulsion device generates a propulsive force for moving the ship forward, a neutral position where the jet propulsion device does not generate a propulsive force for moving the ship, a reverse position where the jet propulsion device generates a propulsive force for moving the ship backward, a forward-side intermediate position between the forward position and the neutral position, and a reverse-side intermediate position between the reverse position and the neutral position, and both control of the position of the bucket including the forward-side intermediate position and the reverse-side intermediate position and control of a rotational speed of the engine are performed when the feedback control is performed.

[0257] All or some of the functions of the units provided in the ships **1** in the embodiments described above can be implemented by recording a program for implementing these functions on a computer-readable recording medium and causing a computer system to read and execute the program recorded on the recording medium. The "computer system" as mentioned herein includes hardware such as an OS and peripheral devices.

[0258] The "computer-readable recording medium" refers to a portable medium such as a flexible disc, a magneto-optical disc, a ROM, or a CD-ROM, or a storage unit such as a hard disk built into the computer system. Furthermore, the "computer-readable recording medium" may also include a medium dynamically storing the program for a short period of time such as a communication cable used when transmitting the program through a network such as the Internet or through a communication line such as a telephone line as well as a medium storing the program for a fixed period of time such as a volatile memory inside the computer system serving as a server or a client in the above-described case. The above-described program may also be for implementing some of the above-described functions or may be implemented by combining the above-described functions with a program already recorded in the computer system.

REFERENCE SIGNS LIST

[0259] **1** Ship
[0260] **11** Engine
[0261] **12** Jet propulsion device
[0262] **12**A Nozzle
[0263] **12**B Bucket
[0264] **13** Ship controller
[0265] **13**A Bucket position control unit
[0266] **13**B Engine rotational speed control unit
[0267] **14** Ship position detection unit
[0268] **15** Operation unit
[0269] **15**A Throttle operation unit
[0270] **15**B Shift operation unit

1. A ship comprising:
an engine that outputs a driving force;
a jet propulsion device that generates a propulsion force of the ship using the driving force output from the engine;
a ship controller that controls the engine and the jet propulsion device; and
a ship position detection unit that detects an actual ship position which is an actual position of the ship,
wherein the jet propulsion device includes a nozzle that ejects a jet stream generated by the driving force output from the engine, and
a bucket that changes a direction of the jet stream ejected from the nozzle,
the position of the bucket includes at least
a forward position where the jet propulsion device generates a propulsive force for moving the ship forward,
a neutral position where the jet propulsion device does not generate a propulsive force for moving the ship, and
a forward-side intermediate position between the forward position and the neutral position,
the ship controller has a ship fixed point holding mode in which feedback control of the engine and the jet propulsion device is performed based on a deviation

between a target ship position, which is a preset target position of the ship, and the actual ship position, and

both control of the position of the bucket including the forward-side intermediate position and control of a rotational speed of the engine are performed in the ship fixed point holding mode.

2. The ship according to claim **1**,

wherein the forward-side intermediate position between the forward position and the neutral position includes a plurality of forward-side intermediate positions, and

the control performed by the ship controller in the ship fixed point holding mode includes control of setting the rotational speed of the engine to a predetermined value so that the ship is held at a fixed point of the target ship position and setting the position of the bucket to any of the forward position, the neutral position, and the plurality of forward-side intermediate positions.

3. The ship according to claim **1**,

wherein the forward-side intermediate position between the forward position and the neutral position includes a linear forward-side intermediate position that is linearly adjustable, and

the control performed by the ship controller in the ship fixed point holding mode includes control of setting the rotational speed of the engine to a predetermined value so that the ship is held at a fixed point of the target ship position and adjusting the linear forward-side intermediate position.

4. The ship according to claim **2**,

wherein, when the actual ship position is located behind the target ship position if the position of the bucket is set to the neutral position in the ship fixed point holding mode, the position of the bucket is set to the forward-side intermediate position, and the rotational speed of the engine is set to a predetermined value so that the ship is held at a fixed point of the target ship position, and when the actual ship position is located ahead of the target ship position if the position of the bucket is set to the forward position in the ship fixed point holding mode, the position of the bucket is set to the forward-side intermediate position, and the rotational speed of the engine is set to a predetermined value so that the ship is held at a fixed point of the target ship position.

5. A ship comprising:

an engine that outputs a driving force;

a jet propulsion device that generates a propulsion force of the ship using the driving force output from the engine;

a ship controller that controls the engine and the jet propulsion device; and

a ship position detection unit that detects an actual ship position which is an actual position of the ship,

wherein the jet propulsion device includes

a nozzle that ejects a jet stream generated by the driving force output from the engine, and

a bucket that changes a direction of the jet stream ejected from the nozzle,

the position of the bucket includes at least

a forward position where the jet propulsion device generates a propulsive force for moving the ship forward,

a neutral position where the jet propulsion device does not generate a propulsive force for moving the ship,

a reverse position where the jet propulsion device generates a propulsive force for moving the ship backward, and

a reverse-side intermediate position between the reverse position and the neutral position,

the ship controller has a ship fixed point holding mode in which feedback control of the engine and the jet propulsion device is performed based on a deviation between a target ship position, which is a preset target position of the ship, and the actual ship position, and

both control of the position of the bucket including the reverse-side intermediate position and control of a rotational speed of the engine are performed in the ship fixed point holding mode.

6. The ship according to claim **5**,

wherein the reverse-side intermediate position between the reverse position and the neutral position includes a plurality of reverse-side intermediate positions, and

the control performed by the ship controller in the ship fixed point holding mode includes control of setting the rotational speed of the engine to a predetermined value so that the ship is held at a fixed point of the target ship position and setting the position of the bucket to any of the reverse position, the neutral position, and the plurality of reverse-side intermediate positions.

7. The ship according to claim **5**,

wherein the reverse-side intermediate position between the reverse position and the neutral position includes a linear reverse-side intermediate position that is linearly adjustable, and

the control performed by the ship controller in the ship fixed point holding mode includes control of setting the rotational speed of the engine to a predetermined value so that the ship is held at a fixed point of the target ship position and adjusting the linear reverse-side intermediate position.

8. The ship according to claim **6**,

wherein, when the actual ship position is located ahead of the target ship position if the position of the bucket is set to the neutral position in the ship fixed point holding mode, the position of the bucket is set to the reverse-side intermediate position, and the rotational speed of the engine is set to a predetermined value so that the ship is held at a fixed point of the target ship position, and when the actual ship position is located behind the target ship position if the position of the bucket is set to the reverse position in the ship fixed point holding mode, the position of the bucket is set to the reverse-side intermediate position, and the rotational speed of the engine is set to a predetermined value so that the ship is held at a fixed point of the target ship position.

9. A ship comprising:

an engine that outputs a driving force;

a jet propulsion device that generates a propulsion force of the ship using the driving force output from the engine;

a ship controller that controls the engine and the jet propulsion device; and

a ship position detection unit that detects an actual ship position which is an actual position of the ship,

wherein the jet propulsion device includes

a nozzle that ejects a jet stream generated by the driving force output from the engine, and

a bucket that changes a direction of the jet stream ejected from the nozzle,

the position of the bucket includes at least

a forward position where the jet propulsion device generates a propulsive force for moving the ship forward,

a neutral position where the jet propulsion device does not generate a propulsive force for moving the ship,

a reverse position where the jet propulsion device generates a propulsive force for moving the ship backward,

a forward-side intermediate position between the forward position and the neutral position, and

a reverse-side intermediate position between the reverse position and the neutral position,

the ship controller has a ship fixed point holding mode in which feedback control of the engine and the jet propulsion device is performed based on a deviation between a target ship position, which is a preset target position of the ship, and the actual ship position, and

both control of the position of the bucket including the forward-side intermediate position and the reverse-side intermediate position and control of a rotational speed of the engine are performed in the ship fixed point holding mode.

10. The ship according to claim **9**,

wherein the forward-side intermediate position between the forward position and the neutral position includes a plurality of forward-side intermediate positions,

the reverse-side intermediate position between the reverse position and the neutral position includes a plurality of reverse-side intermediate positions, and

the control performed by the ship controller in the ship fixed point holding mode includes control of setting the rotational speed of the engine to a predetermined value so that the ship is held at a fixed point of the target ship position and setting the position of the bucket to any of the forward position, the neutral position, the reverse position, the plurality of forward-side intermediate positions, and the plurality of reverse-side intermediate positions.

11. The ship according to claim **9**,

wherein the forward-side intermediate position between the forward position and the neutral position includes a linear forward-side intermediate position that is linearly adjustable,

the reverse-side intermediate position between the reverse position and the neutral position includes a linear reverse-side intermediate position that is linearly adjustable, and

the control performed by the ship controller in the ship fixed point holding mode includes control of setting the rotational speed of the engine to a predetermined value so that the ship is held at a fixed point of the target ship position and adjusting the linear forward-side intermediate position and the linear reverse-side intermediate position.

12. The ship according to claim **10**,

wherein, when the actual ship position is located behind the target ship position if the position of the bucket is set to the neutral position in the ship fixed point holding mode, and when the actual ship position is located ahead of the target ship position if the position of the bucket is set to the forward position, the position of the bucket is set to the forward-side intermediate position, and the rotational speed of the engine is set to a predetermined value so that the ship is held at a fixed point of the target ship position.

13. The ship according to claim **10**,

wherein, when the actual ship position is located ahead of the target ship position if the position of the bucket is set to the neutral position in the ship fixed point holding mode, and when the actual ship position is located behind the target ship position if the position of the bucket is set to the reverse position, the position of the bucket is set to the reverse-side intermediate position, and the rotational speed of the engine is set to a predetermined value so that the ship is held at a fixed point of the target ship position.

14-22. (canceled)

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