A method for controlling dehydration of a washing machine, in which one reference degree of eccentricity in the direction, in which the vibration of a tub is large, is set to be lower than the other reference degree of eccentricity in the direction, in which the vibration of the tub is small, or one reference degree of eccentricity in the direction to the installation of a drying device is set to be lower than the other reference degree of eccentricity in the reverse direction, thereby preventing the washing machine from being excessively vibrated and allowing the washing machine to easily perform a dehydrating operation.
FIG. 1 (Prior Art)
FIG. 3 (Prior Art)

Start

Sense quantity of laundry \( \rightarrow S1 \)

Rotate drum in one direction of clockwise and counterclockwise directions \( \rightarrow S2 \)

Sense degree of eccentricity (UB) \( \rightarrow S3 \)

Sensed degree of eccentricity (UB) \( \leq \) reference degree of eccentricity (Pass UB)?

Yes \( \rightarrow S5 \) Main-dehydrate laundry

No \( \rightarrow S4 \)

Disentangle laundry \( \rightarrow S6 \)

Rotate drum in reverse direction \( \rightarrow S7 \)

End
FIG. 5

Start

S11 Sense quantity of laundry

S12 Rotate drum in one direction of clockwise and counterclockwise directions

S13 Sense degree of eccentricity (UBCCW)

S14 Sensed degree of eccentricity (UBCCW) < first reference degree of eccentricity (Pass UBCCW)?

Yes

S15 Main-dehydrate laundry

No

Disentangle laundry

S16 Disentangle laundry

S17 Rotate drum in reverse direction

S18 Sense degree of eccentricity (UBCCW)

S19 Sensed degree of eccentricity (UBCCW) < second reference degree of eccentricity (Pass UBCCW, Pass UBCCW < Pass UBCCW)?

Yes

S20 Disentangle laundry

End
METHOD FOR CONTROLLING DEHYDRATION OF WASHING MACHINE

BACKGROUND OF THE INVENTION

[0001] 1. Field of the Invention

[0002] The present invention relates to a method for controlling dehydration of a washing machine, and more particularly, to a method for controlling dehydration of a washing machine, which determines whether or not dehydration is performed in consideration of a difference of vibrations of a tub between rotations of a drum in clockwise and counterclockwise directions.

[0003] 2. Description of the Related Art

[0004] Generally, a washing machine is an apparatus for removing contaminants from laundry using functions of a detergent and water. Recently, various auxiliary devices, such as a drying device for drying laundry, are connected to a tub of the washing machine.

[0005] FIG. 1 is a longitudinal sectional view of a conventional washing machine, and FIG. 2 is an exploded perspective view of the conventional washing machine, front and upper surfaces of which are opened from a main body of the washing machine.

[0006] The conventional washing machine, as shown in FIGS. 1 and 2, comprises a casing 2, a tub 10 installed in the casing 2 for containing wash water, a drum 20 rotatably placed in the tub 10 for containing laundry (m), a motor 30 for simultaneously supporting and rotating the drum 20, and a drying device 40 for inhaling air in the drum 20, condensing and heating the air, circulating the air into the drum 20 to dry the laundry (m) in the drum 20.

[0007] An opening 2a for allowing the laundry (m) to be put into and taken out of the casing 2 therewith is formed through one surface of the casing 2, and a door 4 for opening and closing the opening 2a is installed on the casing 2.

[0008] The tub 10 is suspended from springs 5 connected the upper part of the casing 2, and is mounted on dampers 6 installed on the lower part of the casing 2, thereby being supported such that shock imposed on the tub 10 can be absorbed.

[0009] Each of the springs 5 includes a left spring connected to the upper part of the left side of the casing 2 and the upper part of the left side of the tub 10, and a right spring connected to the upper part of the right side of the casing 2 and the upper part of the right side of the tub 10.

[0010] The number of the left springs and the number of the right springs of the springs 5 may be the same as each other, or may differ from each other.

[0011] Each of the dampers 6 includes a left damper connected to the lower part of the left side of the casing 2 and the lower part of the left side of the tub 10, and a right spring connected to the lower part of the right side of the casing 2 and the lower part of the right side of the tub 10.

[0012] The number of the left dampers and the number of the right dampers of the dampers 6 may be the same as each other, or may differ from each other.

[0013] A water supply device 12 for supplying wash water, which is fed from the outside, to the inside of the tub 10, and a drainage device 14 for discharging the wash water from the inside of the tub 10 to the outside are connected to the tub 10.

[0014] An opening 21 for allowing the laundry (m), the wash water, and air to be put into and taken out of the drum 20 therethrough, and through holes 22 for passing the wash water and the air therethrough are formed through the drum 20.

[0015] A rotary shaft of the motor 30 passes through the tub 10, and is supported by the tub 10 by a bearing. A front end of the rotary shaft of the motor 30 is connected to the drum 20.

[0016] The motor 30 includes a sensing device, such as a hall sensor, for sensing the rotational frequency (rpm) or rotational angle thereof.

[0017] The drying device 40 includes a condensing duct 42 connected to one side of the tub 10, a cooling water nozzle 44 for spraying cooling water onto the condensing duct 42, and a drying duct 48 communicating with the condensing duct 42 and containing a circulation fan 45 and a heater 46 for circulating air in a high-temperature and low-humidity state into the drum 20.

[0018] The washing machine further comprises a controller for controlling the water supply device 12, the drainage device 14, and the motor 13 based on user's manipulation or the sensed quantity of laundry and the sensed degree of eccentricity.

[0019] Hereinafter, the operation of the above conventional washing machine will be described in detail.

[0020] First, laundry (m) is put into the drum 20, and the door 4 is closed. Thereafter, when the washing machine is operated, the controller senses the quantity of the laundry (m) in the drum 20, and sets a wash water level, a washing time, a quantity of a detergent, and a type of water current, such as a rinsing water current or a wash water current, based on the sensed quantity of the laundry (m).

[0021] The controller controls the water supply device 12 based on the sensed quantity of the laundry (m) for a designated time such that the wash water is supplied to a designated level in the washing machine, and the supplied wash water is supplied into the tub 10. Thereafter, the controller rotates the motor 30 at a designated rotational frequency for a designated time such that the drum 20 is rotated by the motor 30, and dirt is removed from the laundry (m) contained in the drum 20 by the action of the wash water. After the above-described washing operation is completed, the contaminated wash water in the tub 10 is discharged to the outside of the washing machine through the drainage device 14.

[0022] Further, the washing machine performs a rinsing operation for eliminating foam remaining in the laundry (m) several times. In the same manner as the washing operation, the controller controls the water supply device 12 and the motor 30 based on the sensed quantity of the laundry (m). Then, the contaminated water containing the foam is discharged to the outside of the washing machine through the drainage device 14.

[0023] After the repetitions of the rinsing operation are completed, the washing machine performs a dehydrating operation for centrifugally dehydrating the laundry (m).
The dehydrating operation includes sensing the quantity of the laundry to determine an optimum dehydrating time or an optimum dehydrating rotational frequency, sensing a degree of eccentricity to determine whether or not the dehydrating operation is performed, or the laundry (m) are disentangled, and main-dehydrating the laundry (m) by rotating the motor 30 at a high speed after sensing the quantity of the laundry or sensing the degree of eccentricity.

FIG. 3 is a flow chart illustrating a dehydrating operation of the conventional washing machine.

As shown in FIG. 3, after the washing or rinsing operation is completed, the washing machine senses the quantity of the laundry (m) and senses the degree of eccentricity.

When sensing the quantity of the laundry (m), the motor 30 starts its operation such that the motor 30 maintains a constant rotational speed for a designated time, and is turned off. A pulse width modulation (PWM) duty value from the start of the operation of the motor 30 to the termination of the maintaining of the regular rotational speed of the motor 30 and a surplus rotational angle of the motor 30 after the turn-off of the motor 30 are measured, thereby sensing the quantity of the laundry (m) (S1).

When sensing the degree of eccentricity, the motor 30 is operated such that the drum 20 is rotated in either one direction of clockwise and counterclockwise directions (for example, the clockwise direction), and a degree of eccentricity (UB1) is sensed during the operation of the motor 30 (S2 and S3).

Thereafter, in case that the sensed degree of eccentricity (UB1) is lower than a reference degree of eccentricity (Pass UB) for determining whether or not a dehydrating operation starts, the drum 20 is rotated in the above direction (for example, the clockwise direction) so that the main dehydrating of the laundry (m) is performed (S4 and S5).

On the other hand, in case that the sensed degree of eccentricity (UB1) is not lower than the reference degree of eccentricity (Pass UB), it is determined that the degree of eccentricity (UB1) is excessive, the disentanglement of the laundry (m) is performed, and the sense of the degree of eccentricity is performed again (S6).

The motor 30 of the washing machine is then rotated in the reverse direction such that the drum 20 is rotated in the other direction of clockwise and counterclockwise directions (for example, the counterclockwise direction), and a degree of eccentricity (UB1) is re-sensed using a variation of the rotational frequency during the reverse operation of the motor 30 (S7 and S3).

Thereafter, in case that the re-sensed degree of eccentricity (UB1) is lower than the reference degree of eccentricity (Pass UB) for determining whether or not the dehydrating operation starts, the drum 20 is rotated in the reverse direction (for example, the counterclockwise direction). On the other hand, in case that the re-sensed degree of eccentricity (UB1) is not lower than the reference degree of eccentricity (Pass UB), it is determined that the degree of eccentricity (UB1) is excessive, the disentanglement of the laundry (m) is performed again, and then the sense of the degree of eccentricity is performed again. Then, the above-described regular and reverse rotations of the drum 20, sense of the degree of eccentricity, comparison, and disentanglement of the laundry (m) are repeated until subsequent degrees of eccentricity (UB2, UB3, ...) are lower than the reference degree of eccentricity (Pass UB).

The main dehydrating of the laundry (m) is performed for an optimum dehydrating time or at an optimum dehydrating rotational frequency based on the quantity of the laundry (m) obtained in the sense of the laundry (m). Here, the laundry is centrifugally dehydrated at a high speed.

Thereafter, after the dehydrating operation of the washing machine is completed, the drying device 40 is operated, thereby performing a drying operation.

In case that the tub 10 of the conventional washing machine is supported by the springs 5 or the dampers 6 such that the tub 10 is bilaterally asymmetrical, vibrations having different degrees are generated from the rotations of the tub 10 in the clockwise direction and the counterclockwise direction, thereby causing the tub 10 or the drying device 40 to collide with the casing 2 and generating excessive vibration of the washing machine.

Further, in case that the drying device 40 is installed eccentrically on one side of left and right sides of the tub 10, the distance between one side of the drying device 40 and the casing 2 is shorter than that between the other side of the drying device 40 and the casing 2, thereby causing the drying device 40 to easily collide with the casing 2.

The reference degree of eccentricity (Pass UB), which is set to a low value in order to prevent the above excessive vibration or collision, increases the number of the repetitions of the sense of the degree of eccentricity and the disentanglement of the laundry (m), thereby causing a failure in performing the dehydrating operation or lengthening the overall dehydrating time.

SUMMARY OF THE INVENTION

Therefore, the present invention has been made in view of the above problems, and it is an object of the present invention to a method for controlling dehydration of a washing machine, in which reference degrees of eccentricity of rotations of a drum in the clockwise and counterclockwise directions are set to different values, thereby preventing the washing machine from being excessively vibrated and allowing the washing machine to advance into a dehydrating operation.

In accordance with one aspect of the present invention, the above and other objects can be accomplished by the provision of a method for controlling dehydration of a washing machine, in which reference degrees of eccentricity in the clockwise and counterclockwise direction of a drum, for determining whether or not main dehydration is performed, are set to different values.

Preferably, the reference degree of eccentricity in the direction, in which the vibration of a tub is large, may be set to be lower than the reference degree of eccentricity in the direction, in which the vibration of the tub is small.

Preferably, in case that a drying device is eccentrically installed at left or right side from the center of a tub, one reference degree of eccentricity in the direction of
installation of the drying device may be set to be lower than the other reference degree of eccentricity in the reverse direction.

[0042] Further, preferably, in case that the numbers of dampers connected to left and right sides of a tub differ from each other, one reference degree of eccentricity in the direction to the dampers having a small number may be set to be lower than the other reference degree of eccentricity in the reverse direction.

[0043] Moreover, preferably, in case that the numbers of springs connected to left and right sides of a tub differ from each other, one reference degree of eccentricity in the direction to the springs having a small number may be set to be lower than the other reference degree of eccentricity in the reverse direction.

[0044] In accordance with another aspect of the present invention, there is provided a method for controlling dehydration of a washing machine, comprising the steps of: (i) rotating a drum in one direction out of the clockwise and counterclockwise directions, and sensing a degree of eccentricity; (ii) stopping the rotation of the drum when the degree of eccentricity sensed in step (i) is not lower than a first reference degree of eccentricity, and performing main dehydration when the degree of eccentricity sensed in step (i) is lower than the first reference degree of eccentricity; (iii) rotating the drum in the direction reverse to the rotation in step (i) when the rotation of the drum is stopped in step (ii), and sensing a degree of eccentricity; and (iv) stopping the rotation of the drum when the degree of eccentricity sensed in step (iii) is not lower than a second reference degree of eccentricity, and performing main dehydration when the degree of eccentricity sensed in step (iii) is lower than the second reference degree of eccentricity, wherein all steps of step (i) are repeated in case that the rotation of the drum is stopped in step (iv).

[0045] In accordance with yet another aspect of the present invention, there is provided a method for controlling dehydration of a washing machine, comprising the steps of: (i) rotating a drum in one direction out of the clockwise and counterclockwise directions, and sensing a degree of eccentricity; (ii) stopping the rotation of the drum and performing disentanglement of laundry when the degree of eccentricity sensed in step (i) is not lower than a first reference degree of eccentricity, and performing main dehydration when the degree of eccentricity sensed in step (i) is lower than the first reference degree of eccentricity; (iii) rotating the drum in the direction reverse to the rotation in step (i) when the rotation of the drum is stopped and the disentanglement of laundry is performed in step (ii), and sensing a degree of eccentricity; and (iv) stopping the rotation of the drum and performing disentanglement of laundry when the degree of eccentricity sensed in step (iii) is not lower than a second reference degree of eccentricity set to a value differing from that of the first reference degree of eccentricity, and performing main dehydration when the degree of eccentricity sensed in step (iii) is lower than the second reference degree of eccentricity, wherein all steps from step (i) are repeated in case that the rotation of the drum is stopped and the disentanglement of laundry is performed in step (iv).

[0046] Preferably, in the sense of the degree of eccentricity, a motor for rotating the drum may be accelerated such that the rotational frequency (rpm) of the motor reaches a predetermined rotational frequency (rpm), the motor may be maintained at a constant rotational speed for a predetermined time when the rotational frequency (rpm) of the motor reaches the predetermined rotational frequency (rpm), and then the motor may be turned off; and the degree of eccentricity may be sensed using a variation of the rotational speed (rpm) during a time of maintaining the motor at the constant speed.

[0047] Preferably, one reference degree of eccentricity, out of the first and second reference degrees of eccentricity, in the direction, in which the vibration of a tub is large, is set to be lower than the other reference degree of eccentricity in the direction, in which the vibration of the tub is small.

[0048] Further, preferably, in case that a drying device is eccentrically installed at left or right side from the center of a tub, one reference degree of eccentricity, out of the first and second reference degrees of eccentricity, in the direction of installation of the drying device may be set to be lower than the other reference degree of eccentricity in the reverse direction.

[0049] Moreover, preferably, in case that left and right suspension systems of the tub are bilaterally asymmetric, one reference degree of eccentricity, out of the first and second reference degrees of eccentricity, in the direction to the suspension system having relatively large vibration may be set to be lower than the other reference degree of eccentricity in the reverse direction.

[0050] Preferably, in case that the numbers of dampers connected to left and right sides of a tub differ from each other, one reference degree of eccentricity, out of the first and second reference degrees of eccentricity, in the direction to the dampers having a small number may be set to be lower than the other reference degree of eccentricity in the reverse direction.

[0051] Further, preferably, in case that the numbers of springs connected to left and right sides of a tub differ from each other, one reference degree of eccentricity, out of the first and second reference degrees of eccentricity, in the direction to the springs having a small number may be set to be lower than the other reference degree of eccentricity in the reverse direction.

[0052] Preferably, the rotations of the drum in the clockwise and counterclockwise directions may be alternately achieved in the disentanglement of laundry.

[0053] Further, preferably, the rotation of the motor in the counterclockwise direction may be performed after a designated time from the stop of the rotation of the drum in the clockwise direction elapses in the disentanglement of laundry.

[0054] In the method of the present invention, one reference degree of eccentricity in the direction, in which the vibration of the tub is large, is set to be lower than the other reference degree of eccentricity in the direction, in which the vibration of the tub is small, thereby preventing the part of the large vibration of the tub from performing a dehydrating operation until the reference degree of eccentricity in the direction to the part of the large vibration of the tub has a small value so as to prevent the washing machine from being
excessively vibrated, and allowing the part of the small vibration of the tub to easily perform the dehydrating operation.

[0055] Further, in the method of the present invention, one reference degree of eccentricity in the direction to the installation of a drying device is set to be lower than the other reference degree of eccentricity in the reverse direction, thereby preventing the drying device from colliding with a casing.

BRIEF DESCRIPTION OF THE DRAWINGS

[0056] The above and other objects, features and other advantages of the present invention will be more clearly understood from the following detailed description taken in conjunction with the accompanying drawings, in which:

[0057] FIG. 1 is a longitudinal sectional view of a conventional washing machine;

[0058] FIG. 2 is an exploded perspective view of the conventional washing machine, front and upper surfaces of which are opened from a main body of the washing machine;

[0059] FIG. 3 is a flow chart illustrating a dehydrating operation of the conventional washing machine;

[0060] FIG. 4 is a graph illustrating a variation of the rotational frequency (rpm) of a motor according to a variation of time in a method for controlling dehydration of a washing machine in accordance with an embodiment of the present invention; and

[0061] FIG. 5 is a flow chart illustrating the method for controlling dehydration of a washing machine in accordance with the embodiment of the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0062] Now, a preferred embodiment of the present invention will be described in detail with reference to the annexed drawings.

[0063] FIG. 4 is a graph illustrating a variation of the rotational frequency (rpm) of a motor according to a variation of time in a method for controlling dehydration of a washing machine in accordance with an embodiment of the present invention, and FIG. 5 is a flow chart illustrating the method for controlling dehydration of a washing machine in accordance with the embodiment of the present invention.

[0064] The method for controlling the dehydration of the washing machine in accordance with this embodiment of the present invention, as shown in FIGS. 4 and 5, comprises sensing a quantity of laundry (section “a”), sensing a degree of eccentricity (sections “b” and “b’”), disentangling the laundry to release the eccentricity of the laundry (section “c’”), and dehydrating the laundry by rotating a drum at a high speed (section “d”).

[0065] In the sense of the quantity of the laundry (section “a”), a motor is accelerated such that the rotational frequency (rpm) of the motor reaches a first predetermined rotational frequency (rpmₐ), the first predetermined rotational frequency (rpmₐ) of the motor is maintained at a constant rotational speed for a predetermined time, and then the motor is turned off. A pulse width modulation (PWM) duty value until the termination of the maintaining of the constant rotational speed of the motor, and a surplus rotational angle of the motor after the turn-off of the motor are measured, thereby sensing the quantity of the laundry (S11).

[0066] In the sense of the quantity of the laundry, the quantity of the laundry is obtained by adding a value, obtained by multiplying the sensed PWM duty value by a proportional constant, to a value, obtained by multiplying the surplus rotational angle by a proportional constant.

[0067] Here, the quantity of the laundry may be obtained by performing the operation of the motor and the calculation once, or may be obtained by repeating the operation of the motor and the calculation twice or more and applying resultant values to a specific equation, for example averaging the resultant values.

[0068] In the sense of the degree of eccentricity (section “b’”), the drum is rotated in either one direction of clockwise and counterclockwise directions (for example, the counterclockwise direction) (S12).

[0069] In the sense of the degree of eccentricity (section “b’’), the motor is accelerated such that the rotational frequency (rpm) of the motor reaches a second predetermined rotational frequency (rpm₂, here, rpm₂ > rpmₐ), the second predetermined rotational frequency (rpm₂) of the motor is maintained at a constant rotational speed for a predetermined time, and then the motor is turned off. An rpm ripple for the time of maintaining the constant rotational speed of the motor is sensed as the degree of eccentricity (UBcw, UBcw) (S13).

[0070] Thereafter, in case that the sensed degree of eccentricity (UBcw) is lower than a first reference degree of eccentricity (Pass UBcw), the drum is rotated in the above direction (for example, the counterclockwise direction) so that the main dehydration of the laundry (section “d’) is performed (S14 and S15).

[0071] Here, the first reference degree of eccentricity (Pass UBcw) is a reference degree of eccentricity for determining whether or not the dehydration of the laundry in the direction of rotation of the drum starts.

[0072] In the main dehydration of the laundry (section “d’”), the motor is accelerated such that the rotational frequency (rpm) of the motor reaches a third predetermined rotational frequency (rpmₐ, here, rpmₐ > rpm₂) determined by the sensed quantity of the laundry, the third predetermined rotational frequency (rpmₐ) of the motor is maintained for a time determined by the sensed quantity of the laundry when the rotational frequency (rpm) of the motor reaches the third predetermined rotational frequency (rpmₐ), and then the motor is turned off.

[0073] On the other hand, in case that the sensed degree of eccentricity (UBcw) is not lower than the first reference degree of eccentricity (Pass UBcw), it is determined that the degree of eccentricity (UBcw) is excessive, and the disentanglement of the laundry (section “c’”) is performed (S16).

[0074] In the disentanglement of the laundry (section “c’”), the motor is operated in regular and reverse directions such that the drum is alternately rotated in the clockwise and counterclockwise directions.

[0075] That is, in the disentanglement of the laundry (section “c’”), after a designated time from the stop of the
After the disentanglement of the laundry (section "c"), the drum is rotated in the reverse direction of the rotation of the drum in the initial sense of the degree of eccentricity (for example, the clockwise direction) (S17).

Here, the motor is accelerated such that the rotational frequency (rpm) of the motor reaches the second predetermined rotational frequency (rpm), the second predetermined rotational frequency (rpm) of the motor is maintained at a constant rotational speed for a predetermined time when the rotational frequency (rpm) of the motor reaches the second predetermined rotational frequency (rpm), and then the motor is turned off. Then, a degree of eccentricity (UBcw) is re-sensed (S18).

In the sense of the degree of eccentricity (section "b"), an rpm ripple for the time of maintaining the constant rotational speed of the motor is sensed as the degree of eccentricity (UBcw). Thereafter, in case that the sensed degree of eccentricity (UBcw) is lower than a second reference degree of eccentricity (Pass UBcw) for determining whether or not the main dehydration of the laundry starts, the drum is rotated in the above direction (for example, the clockwise direction) of rotation of the drum for re-sensing the degree of eccentricity so that the main dehydration of the laundry (section "d") is performed (S19 and S15).

On the other hand, in case that the sensed degree of eccentricity (UBcw) is not lower than the second reference degree of eccentricity (Pass UBcw), it is determined that the degree of eccentricity (UBcw) is excessive, and the disentanglement of the laundry (section "c") is performed again (S20).

Here, the second reference degree of eccentricity (Pass UBcw) refers to a reference degree of eccentricity in the direction of installation of a drying device on the center of the drum, and is set to be lower than the first reference degree of eccentricity (pass UBcw) in the reverse direction.

That is, in case that the drying device is eccentrically installed at left or right side from the center of the drum, when severe vibration is generated from the direction of the installation of the drying device from the center of the drum (for example, the clockwise direction), the drying device collides with a casing. Accordingly, the reference degree of eccentricity (Pass UBcw) in the direction of installation of the drying device (for example, the clockwise direction) is set to be smaller than the reference degree of eccentricity (Pass UBcw) in the reverse direction (for example, the counterclockwise direction), and the dehydration of the laundry in the direction of installation of the drying device is not performed until the sensed degree of eccentricity in the direction of installation of the drying device (for example, the clockwise direction) has a small value, thereby minimizing the collision between the drying device and the casing, and causing the reference degree of eccentricity (Pass UBcw) in the reverse direction (for example, the counterclockwise direction) to have a relatively large value, thus facilitating the start of the dehydration of the laundry.

Further, the second reference degree of eccentricity (Pass UBcw) is a reference degree of eccentricity in the direction (for example, the clockwise direction), in which the vibration of the tub is large, out of the clockwise and counterclockwise directions of the drum, and is set to be lower than the first reference degree of eccentricity (Pass UBcw).

That is, in case that the numbers of dampers for supporting left and right sides of the lower part of the tub differ from each other or the numbers of springs for supporting left and right sides of the upper part of the tub differ from each other, left and right suspension systems of the tub are bilaterally asymmetric so that different vibrations are generated from left and right parts of the tub. When the reference degree of eccentricity (Pass UBcw) in the direction to the suspension system having a relatively large vibration is set to be lower than the reference degree of eccentricity (Pass UBcw) in the direction to the other suspension system, and the dehydration of laundry in the direction to the part of the large vibration is not performed until the sensed degree of eccentricity in the direction to the part of the large vibration (for example, the clockwise direction) has a small value, thereby preventing severe vibration from being generated in one direction out of the left and right directions, and causing the reference degree of eccentricity (Pass UBcw) in the reverse direction to the part of the small vibration (for example, the counterclockwise direction) to have a relatively large value, thus facilitating the start of the dehydration of the laundry.

After the disentanglement of the laundry (section "c"), the washing machine repeats the above rotation of the drum in the clockwise/counterclockwise directions, the sense of the degree of eccentricity (sections "b" and "b"), the comparison, and the disentanglement of the laundry (section "c").

That is, after the disentanglement of the laundry (section "c") is performed again, the drum 20 is rotated in the same direction (for example, the counterclockwise direction) as the rotation of the drum in the initial sense of the degree of eccentricity, and the degree of eccentricity is re-sensed, and, in case that the re-sensed degrees of eccentricity (UBcw, UBCcw, . . .) are lower than the first reference degree of eccentricity (Pass UBcw), the main dehydration of the laundry is performed in the above rotational direction. Then, the drum 20 is rotated in the direction (for example, the clockwise direction) reverse to the rotation of the drum in the initial sense of the degree of eccentricity, and the degree of eccentricity is re-sensed, and, in case that the re-sensed degrees of eccentricity (UBcw, UBCcw, . . .) are lower than the second reference degree of eccentricity (Pass UBcw), the main dehydration of the laundry is performed in the above rotational direction.

As apparent from the above description, the present invention provides a method for controlling dehydration of a washing machine, in which one reference degree of eccentricity in the direction, in which the vibration of the tub is large, tub is set to be lower than the other reference degree of eccentricity in the direction, in which the vibration of the tub is small, thereby preventing the part of the large vibration of the tub from performing a dehydrating operation until the reference degree of eccentricity in the direction to the part of a large vibration of the tub has a small value so as to prevent the washing machine from being excessively vibrated, and allowing the part of the small vibration of the tub to easily perform the dehydrating operation.
Further, in the method of the present invention, one reference degree of eccentricity in the direction to the installation of a drying device is set to be lower than the other reference degree of eccentricity in the reverse direction, thereby preventing the drying device from colliding with a casing.

Although the preferred embodiment of the present invention has been disclosed for illustrative purposes, those skilled in the art will appreciate that various modifications, additions and substitutions are possible, without departing from the scope and spirit of the invention as disclosed in the accompanying claims.

What is claimed is:

1. A method for controlling dehydration of a washing machine, in which reference degrees of eccentricity in the clockwise and counterclockwise direction of a drum, for determining whether or not main dehydration is performed, are set to different values.

2. The method as set forth in claim 1,

wherein the reference degree of eccentricity in the direction, in which the vibration of a tub is large, is set to be lower than the reference degree of eccentricity in the direction, in which the vibration of the tub is small.

3. The method as set forth in claim 1,

wherein, in case that a drying device is eccentrically installed at left or right side from the center of a tub, one reference degree of eccentricity in the direction of installation of the drying device is set to be lower than the other reference degree of eccentricity in the reverse direction.

4. The method as set forth in claim 1,

wherein, in case that the numbers of dampers connected to left and right sides of a tub differ from each other, one reference degree of eccentricity in the direction to the dampers having a small number is set to be lower than the other reference degree of eccentricity in the reverse direction.

5. The method as set forth in claim 1,

wherein, in case that the numbers of springs connected to left and right sides of a tub differ from each other, one reference degree of eccentricity in the direction to the springs having a small number is set to be lower than the other reference degree of eccentricity in the reverse direction.

6. A method for controlling dehydration of a washing machine, comprising the steps of:

(i) rotating a drum in one direction out of the clockwise and counterclockwise directions, and sensing a degree of eccentricity;

(ii) stopping the rotation of the drum when the degree of eccentricity sensed in step (i) is not lower than a first reference degree of eccentricity, and performing main dehydration when the degree of eccentricity sensed in step (i) is lower than the first reference degree of eccentricity;

(iii) rotating the drum in the direction reverse to the rotation in step (i) when the rotation of the drum is stopped in step (ii), and sensing a degree of eccentricity; and

(iv) stopping the rotation of the drum when the degree of eccentricity sensed in step (iii) is not lower than a second reference degree of eccentricity, and performing main dehydration when the degree of eccentricity sensed in step (iii) is lower than the second reference degree of eccentricity,

wherein all steps from step (i) are repeated in case that the rotation of the drum is stopped in step (iv).

7. The method as set forth in claim 6,

wherein, in the sense of the degree of eccentricity, a motor for rotating the drum is accelerated such that the rotational frequency (rpm) of the motor reaches a predetermined rotational frequency (rpm), the motor is maintained at a constant rotational speed for a predetermined time when the rotational frequency (rpm) of the motor reaches the predetermined rotational frequency (rpm), and then the motor is turned off; and the degree of eccentricity is sensed using a variation of the rotational speed (rpm) during a time of maintaining the motor at the constant speed.

8. The method as set forth in claim 6,

wherein one reference degree of eccentricity, out of the first and second reference degrees of eccentricity, in the direction, in which the vibration of a tub is large, is set to be lower than the other reference degree of eccentricity in the direction, in which the vibration of the tub is small.

9. The method as set forth in claim 6,

wherein, in case that a drying device is eccentrically installed at left or right side from the center of a tub, one reference degree of eccentricity, out of the first and second reference degrees of eccentricity, in the direction of installation of the drying device is set to be lower than the other reference degree of eccentricity in the reverse direction.

10. The method as set forth in claim 6,

wherein, in case that the numbers of dampers connected to left and right sides of a tub differ from each other, one reference degree of eccentricity, out of the first and second reference degrees of eccentricity, in the direction to the dampers having a small number is set to be lower than the other reference degree of eccentricity in the reverse direction.

11. The method as set forth in claim 6,

wherein, in case that the numbers of springs connected to left and right sides of a tub differ from each other, one reference degree of eccentricity, out of the first and second reference degrees of eccentricity, in the direction to the springs having a small number is set to be lower than the other reference degree of eccentricity.

12. A method for controlling dehydration of a washing machine, comprising the steps of:

(i) rotating a drum in one direction out of the clockwise and counterclockwise directions, and sensing a degree of eccentricity;

(ii) stopping the rotation of the drum and performing disentanglement of laundry when the degree of eccentricity sensed in step (i) is not lower than a first reference degree of eccentricity, and performing main
dehydration when the degree of eccentricity sensed in step (i) is lower than the first reference degree of eccentricity;

(iii) rotating the drum in the direction reverse to the rotation in step (i) when the rotation of the drum is stopped and the disentanglement of laundry is performed in step (ii), and sensing a degree of eccentricity; and

(iv) stopping the rotation of the drum and performing disentanglement of laundry when the degree of eccentricity sensed in step (iii) is not lower than a second reference degree of eccentricity set to a value differing from that of the first reference degree of eccentricity, and performing main dehydration when the degree of eccentricity sensed in step (iii) is lower than the second reference degree of eccentricity,

wherein all steps from step (i) are repeated in case that the rotation of the drum is stopped and the disentanglement of laundry is performed in step (iv).

13. The method as set forth in claim 12,

wherein, in the sense of the degree of eccentricity, a motor for rotating the drum is accelerated such that the rotational frequency (rpm) of the motor reaches a predetermined rotational frequency (rpm), the motor is maintained at a constant rotational speed for a predetermined time when the rotational frequency (rpm) of the motor reaches the predetermined rotational frequency (rpm), and then the motor is turned off; and the degree of eccentricity is sensed using a variation of the rotational speed (rpm) during a time of maintaining the motor at the constant speed.

14. The method as set forth in claim 12,

wherein one reference degree of eccentricity, out of the first and second reference degrees of eccentricity, in the direction, in which the vibration of a tub is large, is set to be lower than the other reference degree of eccentricity in the direction, in which the vibration of the tub is small.

15. The method as set forth in claim 12,

wherein, in case that a drying device is eccentrically installed at left or right side from the center of a tub, one reference degree of eccentricity, out of the first and second reference degrees of eccentricity, in the direction of installation of the drying device is set to be lower than the other reference degree of eccentricity in the reverse direction.

16. The method as set forth in claim 12,

wherein, in case that left and right suspension systems of the tub are bilaterally asymmetric, one reference degree of eccentricity, out of the first and second reference degrees of eccentricity, in the direction to the suspension system having relatively large vibration is set to be lower than the other reference degree of eccentricity in the reverse direction.

17. The method as set forth in claim 12,

wherein, in case that the numbers of dampers connected to left and right sides of a tub differ from each other, one reference degree of eccentricity, out of the first and second reference degrees of eccentricity, in the direction to the dampers having a small number is set to be lower than the other reference degree of eccentricity in the reverse direction.

18. The method as set forth in claim 12,

wherein, in case that the numbers of springs connected to left and right sides of a tub differ from each other, one reference degree of eccentricity, out of the first and second reference degrees of eccentricity, in the direction to the springs having a small number is set to be lower than the other reference degree of eccentricity in the reverse direction.

19. The method as set forth in claim 12,

wherein the rotations of the drum in the clockwise and counterclockwise directions are alternately achieved in the disentanglement of laundry.

20. The method as set forth in claim 12,

wherein the rotation of the motor in the counterclockwise direction is performed after a designated time from the stop of the rotation of the drum in the clockwise direction elapses in the disentanglement of laundry.