FORM 2

THE PATENTS ACT, 1970
(39 of 1970)
AND
THE PATENTS RULES, 2003

COMPLETE SPECIFICATION

(See Section 10; rule 13)

TITLE OF THE INVENTION

"METHOD FOR IDENTIFYING FAULT DIRECTION WITHOUT VOLTAGE MEASUREMENT INFORMATION AND DIRECTIONAL ELEMENT THEREOF"

APPLICANT

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The following specification particularly describes
the invention and the manner
in which it is to be performed

CLAIMS

1. A method for identifying the fault direction without voltage measurement information, wherein said method comprises: as to any one of protections,

measuring the current value of the local line;

calculating the fault component current based on said current value, and further calculating the phase angle of said fault component current;

obtaining the phase angles of fault component currents from at least other two lines which are connected to the same busbar with said local line;

comparing the phase angle of fault component current of said local line with that of the other lines; and

identifying the fault direction based on the result of the comparison.

2. A method for identifying the fault direction without voltage measurement information, wherein said method comprises: as to any one of protection,

measuring the current value of the local line;

obtaining current values from at least other two lines which are connected to the same busbar with said local line;

calculating the fault component currents based on the current values from said local line and the other lines, and further calculating the phase angles of said fault component currents;

comparing the phase angle of fault component current of said local line with that of the other lines; and

identifying the fault direction based on the result of the comparison.

3. The method according to claim 1 or 2, wherein said method further comprises:

identifying the fault occurs in the reverse direction for the local protection if the phase angles of fault component currents of said local line and other lines are similar to each other;

identifying the fault occurs in the reverse direction for the local protection if the phase angle of the fault component current of said local line is similar to some of the other lines and almost reverse to the others of the other lines;

and

identifying the fault occurs in the forward direction for the local protection if the phase angle of said local line is almost reverse to all of the other lines.

4. The method according to claim 1 or 2, wherein said method further comprises:

calculating the differences of the phase angles of between said local line and the other lines after getting the phase angles;

comparing said differences of the phase angles with a preset threshold;

identifying the fault occurs in the reverse direction for the local protection if at least one of said differences of the phase angles is less than a preset threshold; and

identifying the fault occurs in the forward direction for the local protection if all differences of the phase angles are much larger than said preset threshold.

5. The method according to any one of above claims, wherein said method further comprises: in the case of the fault in the forward direction for the local protection,

calculating each amplitude of the fault component currents on said local line and the other lines respectively;

comparing the amplitude of the fault component current on the said local line with that of the fault component currents on the other lines; and

determining said amplitude of the fault component current on the said local line is biggest one; otherwise, issuing an alarm or block signal.

6. The method according to any one of above claims, wherein said method is applied in multiple sources connected to the same busbar, multiple sources connected to the different busbars, a distribution system with distributed generation, a distribution network, a transmission network, a traditional substation and/or a digital substation.

7. The method according to any one of above claims, wherein said method can be implemented by the process level, bay level or GOOSE as the

communication means in a digital substation.

8. A directional element for identifying the fault direction without voltage measurement information, wherein said directional element comprises:

a measuring module, configured to measure the current value of the local line;

a calculating module, configured to calculate the fault component current based on said current value, and further calculate the phase angle of said fault component current;

a communication module, configured to obtain the phase angles of fault component currents from at least other two lines which are connected to the same busbar with said local line;

a comparing module, configured to compare the phase angle of fault component current of said local line with that of the other lines; and

an identifying module, configured to identify the fault direction based on the result of the comparison.

9. A directional element for identifying the fault direction without voltage measurement information, wherein said directional element comprises:

a measuring module, configured to measure the current value of the local line;

a communication module, configured to obtain current values from at least other two lines which are connected to the same busbar with said local line;

a calculating module, configured to calculate the fault component currents based on the current values from said local line and the other lines, and further calculate the phase angles of said fault component currents;

a comparing module, configured to compare the phase angle of fault component current of said local line with that of the other lines; and

a identifying module, configured to identify the fault direction based on the result of the comparison.

10. The directional element according to claim 8 or 9, wherein said identifying module further is configured to:

identify the fault occurs in the reverse direction for the local protection if

the phase angles of fault component currents of said local line and other lines are similar to each other;

identify the fault occurs in the reverse direction for the local protection if the phase angle of the fault component current of said local line is similar to some of the other lines and almost reverse to the others of the other lines; and

identify the fault occurs in the forward direction for the local protection if the phase angle of said local line is almost reverse to all of the other lines.

11. The directional element according to claim 8 or 9, wherein

said calculating module is further configured to calculate the differences of the phase angles of between said local line and the other lines after getting the phase angles;

said comparing module is further configured to compare said differences of the phase angles with a preset threshold;

said identifying module is further configured to identify the fault occurs in the reverse direction for the local protection if at least one of said differences of the phase angles is less than a preset threshold; and identify the fault occurs in the forward direction for the local protection if all differences of the phase angles are much larger than said preset threshold.

12. The directional element according to any one of above claims, wherein in the case of the fault in the forward direction for the local protection,

said calculating module is further configured to calculate each amplitude of the fault component currents on said local line and the other lines respectively ;

said comparing module is further configured to compare the amplitude of the fault component current on the said local line with the amplitudes of the fault component currents on the other lines; and

said identifying module is further configured to determine said amplitude of the fault component current on the said local line is biggest one; otherwise, issue an alarm or block signal.

13. The directional element according to any one of claims 8-12, wherein said

directional element is applied in multiple sources connected to the same busbar, multiple sources connected to the different busbars, a distribution system with distributed generation, a distribution network, a transmission network, a traditional substation and/or a digital substation.

14. The directional element according to any one of claims 8-12, wherein said directional element can use process level, bay level or GOOSE as the communication means in a digital substation.

15. The directional element according to any one of claims 8-12, wherein said directional element can be used to form directional pilot protection for transmission or distribution network.

dated this 06 day of June 2014.

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