at the preset speed. The first motor control signal is corresponding to the movement direction indicated by the direction signal and the preset speed.

[0007] In an embodiment, the emergency signal includes a stop signal. The controlling an operating~~motion~~ state of the spreader cable reel based on the emergency signal and a preset operating parameter includes: controlling the spreader cable reel to stop operating.

[0008] In an embodiment, the emergency signal includes a stop signal. The controlling, by the reel motor, the operating~~motion~~ state of the spreader cable reel based on the emergency signal and the preset operating parameter includes: sending a second motor control signal to the reel motor, and controlling, by the reel motor, the spreader cable reel to stop operating.

[0009] In an embodiment, the method further includes: receiving a speed feedback signal; and sending a first fault signal when a difference between a current operating speed indicated by the speed feedback signal and a preset speed is greater than a preset speed threshold.

[0010] In an embodiment, the control loop is further connected to the hoisting mechanism. The method further includes: receiving a speed feedback signal sent by the reel motor; and when a difference between a current operating speed indicated by the speed feedback signal and a preset speed is greater than a preset speed threshold, sending a first fault signal to the control loop to control, by the control loop, the hoisting mechanism to stop operating.

[0011] According to a second aspect, the present application provides a control method of a spreader cable reel, and the method is applied to a control loop of a hoisting mechanism. The control loop of the hoisting mechanism is connected to a controller. The controller, a reel motor and the spreader cable reel are connected in sequence. The method includes: when receiving an emergency mode instruction, sending an emergency signal to the controller to control, by the controller, an operating state of the spreader cable reel based on the emergency signal and a preset operating parameter.

[0012] In an embodiment, the controller, the reel motor and the spreader cable reel are connected in sequence. The controlling an operating state of the spreader cable reel includes: controlling, by the reel motor, the operating state of the spreader cable reel.

[0013] In an embodiment, the control loop is further connected to the hoisting mechanism, and the preset operating parameter includes a preset speed. The method further includes: controlling the hoisting mechanism to stop operating when receiving a first fault signal sent by the controller. The first fault signal is sent by the controller after the controller receives a speed feedback signal sent by the reel motor and a difference between a current operating speed indicated by the speed feedback signal and a preset speed is greater than a preset speed threshold.

[0014] In an embodiment, the control loop is further connected to a cable reel detection limit and the hoisting mechanism. The cable reel detection limit is used to detect a slack status of the spreader cable reel. The method further includes: controlling the hoisting mechanism to stop operating when receiving

implementing the present application. The objectives and other advantages of the present application are implemented or obtained by structures specifically indicated in the description, claims, and accompanying drawings.

[0031] To make the foregoing objectives, features, and advantages of the present application more obvious and understandable, the following describes optional embodiments below in detail in combination with the accompanying drawings.

BRIEF DESCRIPTION OF DRAWINGS

[0032] To describe the technical solutions in the specific implementations of the present application or the prior art more clearly, the accompanying drawings required for describing the specific implementations or the prior art are briefly described below. Apparently, the accompanying drawings in the following description show merely some implementations of the present application, and a person of ordinary skill in the art may still derive other accompanying drawings from these accompanying drawings without creative efforts.

[0033] FIG. 1 is a principle diagram of a control method of a spreader cable reel in an emergency operation mode in the related art according to an embodiment of the present application.

[0034] FIG. 2 is a flowchart of a control method of a spreader cable reel according to an embodiment of the present application.

[0035] FIG. 3 is a flowchart of another control method of a spreader cable reel according to another embodiment of the present application.

[0036] FIG. 4 is a flowchart of another control method of a spreader cable reel according to another embodiment of the present application.

[0037] FIG. 5 is a flowchart of another control method of a spreader cable reel according to another embodiment of the present application.

[0038] FIG. 6 is a specific implementation process diagram of a control method of a spreader cable reel according to an embodiment of the present application.

[0039] FIG. 7 is a principle diagram of a control method of a spreader cable reel according to an embodiment of the present application.

[0040] FIG. 8 is a schematic structural diagram of a control device of a spreader cable reel according to an embodiment of the present application.

[0041] FIG. 9 is a schematic structural diagram of another control device of a spreader cable reel according to an embodiment of the present application.

[0042] FIG. 10 is a principle diagram of a structure of a crane according to an embodiment of the present application.

[0072] In addition, the control loop is further connected to a cable reel detection limit. The cable reel detection limit is used to detect a slack status of the spreader cable reel. When receiving a second fault signal sent by the cable reel detection limit, the control loop controls the hoisting mechanism to stop operating. The second fault signal is used to indicate that the spreader cable reel is in an over-loose state or an over-tight state.

[0073] According to the control method of a spreader cable reel provided in the embodiment of the present application when receiving the emergency mode instruction triggered by a user, the emergency signal is sent to the controller, so that the controller controls, by a reel motor, the operating state of the spreader cable reel based on the emergency signal and the preset operating parameter. This method improves control precision and reliability of synchronous movement of a spreader cable and the hoisting mechanism of the crane in the emergency operation mode, and reduces labor costs.

[0074] An embodiment of the present application further provides another control method of a spreader cable reel. The method is mainly applied to an emergency mode of a crane, and mainly resolves the following problems. In the emergency mode, how to automatically control the spreader cable reel (also referred to as "reel"), how to implement synchronous operation of the spreader cable reel and a hoisting mechanism, and how to protect an operating state of the spreader cable reel.

[0075] The method is implemented based on a control loop, an emergency motor, an emergency power supply, a reel motor, a reel frequency converter and a spreader cable reel power supply. A specific implementation process is shown in FIG. 6. A start signal and a direction signal that are only sent to the emergency motor in the related art are simultaneously sent to the reel frequency converter (equivalent to the controller in the foregoing embodiment, also called a frequency converter) by the control loop. The start signal and the direction signal are usually obtained by an operator by triggering the control loop. The frequency converter controls lifting or lowering speed of the reel by presetting a speed output (equivalent to the preset speed in the foregoing embodiment) that is the same as that of a hoisting emergency mechanism, so that the speed of the reel is synchronized with the speed of the hoisting mechanism, reducing control error or misoperation caused by a human operation. When a speed difference between the spreader cable reel and the hoisting mechanism exceeds an allowable range, or when a cable reel detection~~monitoring~~ limit sends a signal indicating that the cable is too tight or too loose, a power supply of the emergency mechanism may be automatically cut off to ensure safe operation.

[0076] In the emergency mode, an operation of the hoisting mechanism is driven by the emergency motor, and directly controlled by a hardware circuit of the control loop. The control loop sends the start signal and the direction signal (uplink or downlink) of the hoisting mechanism to the frequency converter of the spreader cable reel and uses the two signals as a start signal and a positive and negative signal of the frequency converter, to control start, stop and forward and reverse rotation of the frequency

converter, respectively. The frequency converter controls lifting or lowering speed of the reel by presetting a speed output that is the same as that of the hoisting emergency mechanism, so that the operating speed of the reel is synchronized with that of the hoisting mechanism. When the speed difference between the spreader cable reel and the hoisting mechanism exceeds the allowable range (the speed feedback is implemented by the reel motor, and after receiving speed feedback, the reel frequency converter determines a difference between the operating speed of the reel and a preset speed, to obtain the speed difference between the spreader cable reel and the hoisting mechanism), or when a cable reel sends a signal indicating that the cable is too tight or too loose (the fault feedback is sent from the reel to the control loop of the emergency mechanism), the control loop may automatically switch operation of the hoisting mechanism and the spreader cable reel, to prevent the spreader cable from being damaged. The operating principle is shown in FIG. 7.

[0077] Based on a speed preset function of the reel frequency converter, the method implements automatic control of the spreader cable reel and detection of synchronous operation of the mechanism and the reel in the emergency mode, and protection of the spreader cable, reducing a quantity of on-site operators, and reducing labor costs.

[0078] Corresponding to the embodiments of the control method of a spreader cable reel described above, an embodiment of the present application further provides a control device of a spreader cable reel, and the device is disposed on a controller. The controller is connected to each of a reel motor and a control loop of a hoisting mechanism, ~~the reel motor is connected to the spreader cable reel,~~ and the reel motor is connected to the spreader cable reel. As shown in FIG. 8, the device includes the following modules.

[0079] A signal receiving module 700, configured to receive an emergency signal. Specifically, the signal receiving module 700 is configured to receive an emergency signal sent by the control loop.

[0080] A control module 702, configured to control an operating state of the spreader cable reel based on the emergency signal and a preset operating parameter. Specifically, the control module 702 control, by the reel motor, the operating state of the spreader cable reel.

[0081] Further, the emergency signal includes a start signal and a direction signal, and the preset operating parameter includes a preset speed. The control module is further configured to: send a first motor control signal to the reel motor, and control, by the reel motor, the spreader cable reel to operate in a movement direction indicated by the direction signal and at the preset speed. The first motor control signal is corresponding to the movement direction indicated by the direction signal and the preset speed.

[0082] Further, the emergency signal includes a stop signal. The control module is further configured to: send a second motor control signal to the reel motor, and control, by the reel motor, the spreader cable reel to stop operating.

[0083] Further, the control loop is also connected to the hoisting mechanism. The device further

What is claimed is:

1. A control method of a spreader cable reel, wherein the method is applied to a controller of the spreader cable reel, and the method comprises:

receiving an emergency signal; and

controlling an operating state of the spreader cable reel based on the emergency signal and a preset operating parameter.

2. The method according to claim 1, wherein the controller is connected to each of a reel motor and a control loop of a hoisting mechanism, the reel motor is connected to the spreader cable reel,

the receiving an emergency signal comprises:

receiving an emergency signal sent by the control loop; and

the controlling an operating state of the spreader cable reel based on the emergency signal and a preset operating parameter comprises:

controlling, by the reel motor, the operating state of the spreader cable reel based on the emergency signal and the preset operating parameter.

3. The method according to claim 2, wherein the emergency signal comprises a start signal and a direction signal, the preset operating parameter comprises a preset speed, and

the step of controlling, by the reel motor, the operating state of the spreader cable reel based on the emergency signal and the preset operating parameter comprises:

sending a first motor control signal to the reel motor, and controlling, by the reel motor, the spreader cable reel to operate in a movement direction indicated by the direction signal and at the preset speed, wherein the first motor control signal is corresponding to the movement direction indicated by the direction signal and the preset speed.

4. The method according to any one of claims 1 to 3, wherein the emergency signal comprises a stop signal, and

the controlling an operating~~motion~~ state of the spreader cable reel based on the emergency signal and a preset operating parameter comprises:

controlling the spreader cable reel to stop operating.

5. The method according to claim 2 or 3, wherein the emergency signal comprises a stop signal, and

the controlling, by the reel motor, the operating~~motion~~ state of the spreader cable reel based on the emergency signal and the preset operating parameter comprises:

sending a second motor control signal to the reel motor, and controlling, by the reel motor, the spreader cable reel to stop operating.

6. The method according to any one of claims 1 to 5, further comprising:

receiving a speed feedback signal; and

sending a first fault signal when a difference between a current operating speed indicated by the speed feedback signal and a preset speed is greater than a preset speed threshold.

7. The method according to claim 2 or 3, wherein the control loop is further connected to the hoisting mechanism, and the method further comprises:

receiving a speed feedback signal sent by the reel motor; and

when a difference between a current operating speed indicated by the speed feedback signal and a preset speed is greater than a preset speed threshold, sending a first fault signal to the control loop to control, by the control loop, the hoisting mechanism to stop operating.

8. A control method of a spreader cable reel, wherein the method is applied to a control loop of a hoisting mechanism, the control loop of the hoisting mechanism is connected to a controller, the controller, a reel motor and the spreader cable reel are connected in sequence, and the method comprises:

when receiving an emergency mode instruction, sending an emergency signal to the controller to control, by the controller, an operating state of the spreader cable reel based on the emergency signal and a preset operating parameter.

9. The method according to claim 8, wherein the controller, the reel motor and the spreader cable reel are connected in sequence, and

the controlling an operating state of the spreader cable reel comprises:

controlling, by the reel motor, the operating state of the spreader cable reel.

10. The method according to claim 8 or 9, wherein the control loop is further connected to the hoisting mechanism, the preset operating parameter comprises a preset speed, and the method further comprises:

controlling the hoisting mechanism to stop operating when receiving a first fault signal sent by the controller; and

wherein the first fault signal is sent by the controller after the controller receives a speed feedback signal sent by the reel motor and a difference between a current operating speed indicated by the speed feedback signal and a preset speed is greater than a preset speed threshold.

11. The method according to any one of claims 8 to 10, wherein the control loop is further connected to a cable reel detection limit and the hoisting mechanism, the cable reel detection limit is used to detect a slack status of the spreader cable reel, and the method further comprises:

controlling the hoisting mechanism to stop operating when receiving a second fault signal sent by the cable reel detection limit, wherein the second fault signal is used to indicate that the spreader cable reel is in an over-loose state or an over-tight state.

12. A control device of a spreader cable reel, wherein the device is disposed on a controller of a spreader cable reel, and the device comprises:

a signal receiving module, configured to receive an emergency signal; and

a control module, configured to control an operating state of the spreader cable reel based on the emergency signal and a preset operating parameter.

13. The device according to claim 12, wherein the controller is connected to each of a reel motor and a control loop of a hoisting mechanism, the reel motor is connected to the spreader cable reel,

the signal receiving module is configured to receive an emergency signal sent by the control loop; and

the control module is configured to control, by the reel motor, the operating state of the spreader cable reel based on the emergency signal and the preset operating parameter.

14. The device according to claim 13, wherein the emergency signal comprises a start signal and a direction signal, and the preset operating parameter comprises a preset speed; and

the control module is configured to: send a first motor control signal to the reel motor, and control, by the reel motor, the spreader cable reel to operate in a movement direction indicated by the direction signal and at the preset speed, wherein the first motor control signal is corresponding to the movement direction indicated by the direction signal and the preset speed.

15. The device according to any one of claims 12 to 14, wherein the emergency signal comprises a stop signal, and

the control module is configured to control the spreader cable reel to stop operating.

16. The device according to claim 13 or 14, wherein the emergency signal comprises a stop signal, and

the control module is configured to: send a second motor control signal to the reel motor, and control, by the reel motor, the spreader cable reel to stop operating.

17. The device according to any one of claims 12 to 16, further comprising:

a feedback signal receiving module, configured to receive a speed feedback signal; and

a fault signal sending module, configured to send a first fault signal when a difference between a current operating speed indicated by the speed feedback signal and a preset speed is greater than a preset speed threshold.

~~18. The device according to claim 13 or 14, wherein the control loop is further connected to the hoisting mechanism, and the device further comprises:~~

~~a feedback signal receiving module, configured to receive a speed feedback signal sent by the reel motor; and~~

~~a fault signal sending module, configured to: when a difference between a current operating speed indicated by the speed feedback signal and a preset speed is greater than a preset speed threshold, send a first fault signal to the control loop to control, by the control loop, the hoisting mechanism to stop operating.~~

~~19~~18. A control device of a spreader cable reel, wherein the device is disposed on a control loop of a hoisting mechanism, the control loop of the hoisting mechanism is connected to a controller, the controller, a reel motor and the spreader cable reel are connected in sequence, and the device comprises:

a signal sending module, configured to: when receiving an emergency mode instruction, send an emergency signal to the controller to control, by the controller, an operating state of the spreader cable reel based on the emergency signal and a preset operating parameter.

~~20. The device according to claim 19, wherein the controller, the reel motor and the spreader cable reel are connected in sequence, and~~

~~the signal sending module is configured to control, by the reel motor, the operating state of the spreader cable reel.~~

~~21. The device according to claim 19 or 20, wherein the control loop is further connected to the hoisting mechanism, the preset operating parameter comprises a preset speed, and the device further comprises:~~

~~a first fault control module, configured to: control the hoisting mechanism to stop operating when receiving a first fault signal sent by the controller;~~

~~wherein the first fault signal is sent by the controller after the controller receives a speed feedback signal sent by the reel motor and a difference between a current operating speed indicated by the speed feedback signal and a preset speed is greater than a preset speed threshold.~~

~~22. The device according to any one of claims 19 to 21, wherein the control loop is further connected to a cable reel detection limit and the hoisting mechanism, the cable reel detection limit is used to detect a slack status of the spreader cable reel, and the device further comprises:~~

~~a second fault control module, configured to: control the hoisting mechanism to stop operating when receiving a second fault signal sent by the cable reel detection limit, wherein the second fault signal is used to indicate that the spreader cable reel is in an over-loose state or an over-tight state.~~

~~23~~19. A crane, wherein the crane comprises a hoisting mechanism, a control loop, a controller, a reel motor and a spreader cable reel that are connected in sequence, the controller comprises the control device according to any one of claims 12 to ~~18~~17, and the control loop comprises the control device according to ~~any one of~~ claim~~s 19 to 22~~18.

~~24~~20. A computer-readable storage medium, wherein the computer-readable storage medium stores a computer program, and the computer program is used to perform the method according to any one of claims 1 to 11.