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Electronic brake for vehicle and control method therefor

Abstract

An electronic brake for a vehicle and a control method therefor according to an embodiment of the present disclosure are able to generate a braking force required to safely run the vehicle even if something is wrong with a main brake device, by controlling an auxiliary brake device, which generates a required braking force by serving as a backup for the main brake device.

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Background/Summary

CROSS-REFERENCE TO RELATED APPLICATION

(1) This application claims priority to and the benefit of Korean Patent Application No. 10-2021-0151793, filed on Nov. 5, 2021, the disclosure of which is incorporated herein by reference in its entirety.

TECHNICAL FIELD

(2) The present disclosure relates to an electronic brake for a vehicle and a control method therefor.

BACKGROUND

(3) This section provides background information related to the present disclosure which is not necessarily prior art.

(4) An electronic brake forms a braking force for a wheel brake mechanism using a motor. A brake device including a motor pressurizes a working fluid within a hydraulic circuit of the electronic brake. The pressurized working fluid is selectively carried to a plurality of wheel brake mechanisms through a flow pathway which is formed by opening and closing a plurality of valves on the hydraulic circuit of the electronic brake. The plurality of wheel brake mechanisms slows down or stops wheels by using a hydraulic pressure of the carried working fluid.

(5) An auxiliary brake device was proposed which is configured to generate a braking pressure by serving as a backup for a main brake device of a vehicle when a failure occurs to the main brake device. As a backup for a main controller for controlling the main brake device, an auxiliary controller for controlling the auxiliary brake device may be mounted along with the auxiliary brake device. The auxiliary brake system is configured to go into cooperative control, if the power output of the main brake device does not meet a set condition. Here, the phrase “the power output of the main brake device does not meet a set condition” may mean that something abnormal occurs to the main brake device.

(6) However, even with an auxiliary brake device, a brake device for a vehicle is not able to generate a braking force required to safely run the vehicle, if an abnormality occurs to the auxiliary brake device.

SUMMARY
(7) According to at least one aspect, the present disclosure provides a control method for an electronic brake for a vehicle, the electronic brake comprising a first braking device configured to supply hydraulic pressure to wheel brakes, a second braking device including a pump, that is connected between at least part of the wheel brakes and the first braking device and configured to fluidically disconnect an oil reservoir and an outlet of the pump when a brake pedal is pressed a predetermined distance or greater, and a control unit including a first controller for controlling the first braking device and a second controller for controlling the second braking device, the method comprising: determining, by the control unit, whether something is wrong with the first braking device; based on a determination that something is wrong with the first braking device, determining, by the control unit, whether something is wrong with a blocking valve unit mounted to the second braking device and connected between the oil reservoir and the outlet of the pump; and based on a determination that something is wrong with the blocking valve unit, controlling the first braking device by the first controller so that a flow path on the first braking device connecting the oil reservoir and the outlet of the pump is closed.
(8) According to another aspect, the present disclosure provides an electronic brake for a vehicle, the electronic brake comprising a first braking device configured to supply hydraulic pressure to wheel brakes, a second braking device including a pump, that is connected between at least part of the wheel brakes and the first braking device and configured to fluidically disconnect an oil reservoir and an outlet of the pump when a brake pedal is pressed a predetermined distance or greater, and a control unit for controlling the first braking device and the second braking device, the control unit comprising: a first determining unit which determines whether something is wrong with the first braking device; a second determining unit which, based on a determination that something is wrong with the first braking device, determines whether something is wrong with a blocking valve unit mounted to the second braking device and connected between the oil reservoir and the outlet of the pump; a first controller which, based on a determination that something is wrong with the blocking valve unit, controls the first braking device so that a flow path on the first braking device connecting the oil reservoir and the outlet of the pump is closed; and a second controller which controls the second braking device so that the second braking device generates a required braking force.

Description

BRIEF DESCRIPTION OF THE DRAWINGS
(1) FIG. **1** is a hydraulic circuit diagram of an electronic brake for a vehicle according to an embodiment of the present disclosure.
(2) FIG. **2** is a sequence diagram of a control method according to an embodiment of the present disclosure.
(3) FIG. **3** is a block diagram schematically showing a configuration of an electronic brake for a vehicle according to an embodiment of the present disclosure.
DETAILED DESCRIPTION
(4) An electronic brake for a vehicle and a control method therefor according to an embodiment of the present disclosure are able to generate a braking force required to safely run the vehicle even if something is wrong with a main brake device, by controlling an auxiliary brake device, which generates a required braking force by serving as a backup for the main brake device.
(5) Furthermore, an electronic brake for a vehicle and a control method therefor according to an embodiment of the present disclosure are able to generate a braking force required to safely run the vehicle in a double failure situation, by controlling the main brake device by a control unit so that the main brake device delivers a hydraulic pressure formed by the auxiliary brake device to wheel

brakes if something is wrong with the main brake device and the auxiliary brake device.

(6) The aspects of the present disclosure are not limited to the foregoing, and other aspects not mentioned herein will be able to be clearly understood by those skilled in the art from the following description.

(7) Hereinafter, some exemplary embodiments of the present disclosure will be described in detail with reference to the accompanying drawings. In the following description, like reference numerals preferably designate like elements, although the elements are shown in different drawings. Further, in the following description of some embodiments, a detailed description of known functions and configurations incorporated therein will be omitted for the purpose of clarity and for brevity.

(8) Additionally, various terms such as first, second, A, B, (a), (b), etc., are used solely to differentiate one component from the other but not to imply or suggest the substances, order, or sequence of the components. Throughout this specification, when a part 'includes' or 'comprises' a component, the part is meant to further include other components, not to exclude thereof unless specifically stated to the contrary. The terms such as 'unit', 'module', and the like refer to one or more units for processing at least one function or operation, which may be implemented by hardware, software, or a combination thereof.

(9) FIG. **1** is a hydraulic circuit diagram of an electronic brake for a vehicle according to an embodiment of the present disclosure.

(10) In this disclosure, the terms "front" and "rear" refer to the direction in which a brake pedal **112** is pressurized and the opposite direction thereof, respectively. In this disclosure, front wheel brakes w**3** and w**4** and rear wheel brakes w**1** and w**2** refer to wheel brakes mounted to front wheels and wheel brakes mounted to rear wheels, respectively.

(11) Referring to FIG. **1**, an electronic brake for a vehicle that is controlled by a control method according to an embodiment of the present disclosure includes all or part of an oil reservoir **130**, a first braking device **110**, a second braking device **120**, wheel brakes w**1** to w**4**, and a control unit **150**.

(12) The wheel brakes w**1** to w**4** are devices that are configured to be mounted to wheels and apply a braking force to the wheels. The wheel brakes w**1** to w**4** may be caliper-type brakes or drum-type brakes, for example. The wheel brakes w**1** to w**4** are configured to be supplied with hydraulic pressure from the first and/or second braking device **110** and/or **120** and restrict the rotation of the wheels.

(13) The oil reservoir **130** is installed to store working fluid or supply it to a hydraulic circuit. The fluid in the oil reservoir **130** may be supplied to a master cylinder **111** or a pump **121**, and the fluid may be pressurized in the master cylinder **111** or the pump **121**. The pressurized fluid may be selectively delivered to a plurality of wheel brakes w**1** to w**4** by a plurality of valves mounted on the first braking device **110** and the second braking device **120**.

(14) The first braking device **110** is configured to supply hydraulic pressure to the wheel brakes w**1** to w**4**. The first braking device **110** is connected between the oil reservoir **130** and the wheel brakes w**1** to w**4**. The master cylinder **111** included in the first braking device **110** may pressurize fluid, and the pressurized fluid may be delivered to the wheel brakes w**1** to w**4**.

(15) The master cylinder **111** includes a piston **111***a* configured to pressurize fluid inside of it. An inlet of the master cylinder **111** is communicated to the oil reservoir **130**, and an outlet of the master cylinder **111** is communicated to the wheel brakes w**1** to w**4**. The fluid introduced from the oil reservoir **130** to the master cylinder **111** may be pressurized within the master cylinder **111** and delivered to the wheel brakes w**1** to w**4**. The master cylinder **111** may have two chambers divided by a piston **111***a*. The chamber positioned at the front of the piston **111***a* is referred to as a first chamber **111***b*, and the chamber positioned at the rear of the piston **111***a* is referred to as a second chamber **111***c*. The first chamber **111***b* and the second chamber **111***c* each may be connected to different wheel brakes w**1** to w**4**. The first chamber **111***b* for the control method according to an embodiment of the present disclosure is connected to the wheel brakes w**1** to w**4** mounted to the

rear wheels of the vehicle, and the second chamber **111***c* therefor is connected to the wheel brakes w**1** to w**4** mounted to the front wheels of the vehicle. Here, a flow path connecting the first chamber **111***b* and the wheel brakes w**1** to w**4** mounted to the rear wheels of the vehicle is referred to as a rear wheel flow path. A flow path connecting the second chamber **111***c* and the wheel brakes w**1** to w**4** mounted to the front wheels of the vehicle is referred to as a front wheel flow path. The rear wheel flow path and the front wheel flow path may be configured to be fluidically communicated or disconnected depending on whether a connection valve **114** is open or closed.

(16) The first braking device **110** may include a switch valve unit **115** mounted on a flow path connecting the inside of the master cylinder **111** and the oil reservoir **130**. When the switch valve unit **115** is opened, the master cylinder **111** and the oil reservoir **130** are communicated and a hydraulic pressure in the master cylinder **111** is reduced.

(17) The piston **111***a* may be configured to slide in a direction in which it pressurizes the fluid in the master cylinder **111** as the driver pushes the pedal **112**. Although not shown in FIG. **1**, the master cylinder **111** may include an electronic booster that is configured to move the piston **111***a* based on a brake signal generated by a pedal stroke sensor, when the driver pushes the pedal **112**. When the hydraulic pressure in the second chamber **111** positioned at the front of the piston **111***a* is reduced, the reaction force exerted on the piston **111***a* by the hydraulic pressure in the second chamber **111***c* is reduced when the piston **111***a* is pressurized. Accordingly, the force the driver applies to the brake pedal **112** to move the piston **111***a* forward is reduced.

(18) The piston **111***a* has a predetermined thickness in the direction of movement. The second chamber **111***c* and the wheel brakes w**1** to w**4** mounted to the rear wheels may be fluidically communicated or disconnected depending on the amount of stroke of the piston **111***a*. Referring to FIG. **1**, when the piston **111***a*, is pressed a predetermined distance or greater, an outlet made through the chamber **111***c* is closed by the outer periphery of the piston **1111***a*. In this way, the wheel brakes w**1** to w**4** mounted to the front wheels and the second chamber **111***c* are fluidically disconnected.

(19) The second braking device **120** is connected between at least part of the wheel brakes w**1** to w**4** and the first braking device **110**. The second braking device **120** is configured to generate a required braking force by serving as a backup for the first braking device **110**, when something is wrong with the first braking device **110**. Here, the required braking force is a value that is determined based on the amount of pedal stroke from the driver measured by the pedal stroke sensor, and may mean a braking force equivalent to the driver's intention to slow down or stop the vehicle. On the other hand, the required braking force may mean a braking signal calculated by the autonomous driving system of the vehicle. The second braking device **120** may be disposed in such a way as to supply hydraulic pressure to the front wheel brakes w**3** and w**4**. The electronic brake for a vehicle according to an embodiment of the present disclosure is configured to deliver fluid to the oil reservoir **130**, the first braking device **110**, the second braking device **120**, and the front wheel brakes w**3** and w**4**, sequentially.

(20) The pump **121** included in the second braking device **120** may produce a hydraulic pressure for generating the required braking force. An inlet of the pump **121** may be connected to the oil reservoir **130**, and an outlet of the pump **121** may be connected to the wheel brakes w**1** to w**4**. An inlet flow valve unit **126** may be mounted on a flow path connecting the inlet of the pump **121** and the oil reservoir **130**. When the inlet flow valve unit **126** is opened, fluid may be supplied to the pump **121** from the oil reservoir **130**. If the second braking device **120** needs to increase brake pressure by serving as a backup for the first braking device **110**, fluid may be delivered to the pump **121** from the oil reservoir **130**, and the delivered fluid may be pressurized within the pump **121** and delivered to the wheel brakes w**1** to w**4**. The second braking device **120** may be configured such that the oil reservoir **130** and the outlet of the pump **121** are fluidically disconnected when the brake pedal **112** is pressed a predetermined distance or greater. The second chamber **111***c* may be configured to be communicated to the oil reservoir **130** and the second braking device **120**. With

this configuration, when the piston **111***a* is pressed a predetermined distance or greater, an outlet of the second chamber **111***c* leading to the second braking device **120** may be closed by the outer periphery of the piston **111***a*. Accordingly, a high-pressure fluid pressurized in the second braking device **120** leaks into the oil reservoir **130**, thereby preventing a reduction in the pressure of the fluid.

(21) The second braking device **120** includes all or part of a blocking valve unit **125**, an inlet valve unit IV, and an outlet valve unit OV. The block valve unit **125** is connected between the oil reservoir **130** and the wheel brakes w**1** to w**4**. The blocking valve unit **125** is connected between the oil reservoir **130** and the outlet of the pump **121**. When the blocking valve unit **125** is closed, a high-pressure fluid discharged from the outlet of the pump **121** is kept from being delivered to the oil reservoir **130**. Accordingly, the pressure of the fluid pressurized in the pump **121** may be transferred to the wheel brakes w**1** to w**4**. The inlet valve unit IV is mounted on a flow path connecting the outlet of the pump **121** and the wheel brakes w**1** to w**4**. The inlet valve unit IV may be configured as a normal open-type solenoid valve which is closed when no current is applied to it. The control unit **150** may control the inlet valve unit IV to open and the outlet valve unit OV to close so that the hydraulic pressure formed in the first and second braking devices **110** and **120** is transferred to the wheel brakes w**1** to w**4**. On the other hand, the control unit **150** may control the inlet valve unit IV to close and the outlet valve unit OV to open so that the hydraulic pressure of the wheel brakes w**1** to w**4** is reduced.

(22) FIG. **2** is a sequence diagram of a control method according to an embodiment of the present disclosure.

(23) The control method according to an embodiment of the present disclosure may be performed by the electronic brake for a vehicle illustrated in FIG. **1**.

(24) Referring to FIGS. **1** and **2**, the electronic brake for a vehicle includes the control unit **150**. The control unit **150** includes a first controller **151** for controlling the first braking device **110** and a second controller **152** for controlling the second braking device **120**. The control unit **150** determines whether something is wrong with the first braking device **110** (S**210**). The first controller **151** may determine whether something is wrong with the first braking device **110**, based on a measurement from a pressure sensor mounted on the first braking device **110** or the value of a current applied to a valve mounted on the first braking device **110**. For example, if a pressure measured by the pressure sensor is not high enough to be equivalent to the required braking force, the control unit **150** may determine that something is wrong with the first braking device **110**. If there isn't something wrong with the first braking device **110**, the control method of the present disclosure is completed.

(25) If it is determined that something is wrong with the first braking device **110**, the second controller **152** determines whether something is wrong with the blocking valve unit **125** (S**230**). Specifically, the second controller **152** may determine whether the blocking valve unit **125** gets stuck while opening. If something is wrong with the first braking device **110**, the second controller **152** may control the second braking device **120** so that the second braking device **120** generates the required braking force by serving as a backup for the first braking device **110**. If the blocking valve unit **125** gets stuck while opening, a high-pressure fluid pressurized in the second braking device **120** leaks into the oil reservoir **130**, and the second braking device **120** is therefore unable to generate the required braking force by serving as a backup for the first braking device **110**. The control method for the electronic brake for a vehicle allows the electronic brake for a vehicle to produce the required braking force by using the following control method even in a double failure situation (hereinafter, in the event of a double failure).

(26) If it is determined that something is wrong with the blocking valve unit **125** in S**230**, the first controller **151** controls the first braking device **110** so that a flow path on the first braking device **110** that connects the oil reservoir **130** and the outlet of the pump **121** is closed (S**250** to S**290**).

(27) In the step S**250**, the first controller **151** determines whether the driver is pressing the brake

pedal **112**. The first controller **151** may determine whether the driver is pressing the brake pedal **112** or not, upon receiving a signal related to the amount of stroke of the brake pedal **112** from the pedal stroke sensor connected to the brake pedal **112**. If it is determined that the driver is pressing the brake pedal **112**, the first controller **151** controls the first braking device **110** so as to reduce a hydraulic pressure in the master cylinder **111**. The control unit **150** controls the first and second braking devices **110** and **120** so that the first and second braking devices **110** and **120** produce a required braking force equivalent to the amount of pedal stroke from the driver, under a circumstance in which something is wrong with the first braking device **110** and the blocking valve unit **125**.

(28) In the step S**260**, the first controller **151** controls the switch valve unit **115** so that the switch valve unit **115** is opened, Once the switch valve unit **115** is opened, the hydraulic pressure in the master cylinder **111** is reduced. Accordingly, the reaction force exerted on the piston **111***a* by the fluid in the master cylinder **111** is reduced, making it possible to move the piston **111***a* forward by a small force. Once the piston **111***a* is moved forward a predetermined distance or greater, the oil reservoir **130** and the outlet of the pump **121** are fluidically disconnected. As such, the fluid pressurized by the pump **121** of the second braking device **120** may be delivered to the wheel brakes w**1** to w**4** without leaking into the oil reservoir **130**. By using the control method according to the step S**260**, it is possible for the second braking device **120** to transfer the braking force it produces by serving as a backup for the first braking device **110** to the wheel brakes w**1** to w**4**, when the driver presses the brake pedal **112** with a small force in the event of a double failure.

(29) In the step S**270**, the control unit **150** determines whether to increase the braking force applied to the vehicle by the electronic brake for the vehicle. If the required braking force is greater than a current braking force which is calculated based on a pressure measured by a hydraulic sensor connected to the wheel brakes w**1** to w**4**, the control unit **150** may determine that the braking force needs to be increased. For example, if a hydraulic pressure formed in the master cylinder **111** by the driver's pedal pressure is not high enough to be equivalent to the required braking force, this may mean that the required braking force is greater than the current braking force. The second braking device **120** may form a braking force as a backup for the pedal pressure from the driver.

(30) If it is determined that the braking force needs to be increased in the step S**270**, the second controller **152** controls the inlet flow valve unit **126** so that the inlet flow valve unit **126** mounted on the flow path connecting the oil reservoir **130** and the inlet of the pump **120** is opened (S**290**). Moreover, the second controller **152** controls the pump **121** so that the pump **121** pressurizes fluid. As such, the fluid enters the pump **121** from the oil reservoir **130**, and the fluid is pressurized in the pump **121**. The pressurized fluid may be delivered to the wheel brakes w**1** to w**4** without leaking to the oil reservoir **130** in the step S**260**.

(31) On the other hand, if it is determined that the braking force does not need to be increased in the step S**270**, the second controller **152** controls the open and closed states of the inlet valve unit IV and the outlet valve unit OV (S**280**). That is, the control unit **150** may perform control of ABS (anti-lock brake system), TCS (traction control system), and so on.

(32) If it is determined that there isn't something wrong with the blocking valve unit **125** in the step S**230** the second controller **152** controls the second braking device **120** so that the second braking device **120** generates a hydraulic pressure equivalent to the required braking force (S**240**). That is, the second braking device **120** produces a braking pressure by serving as a backup for the first braking device **110**.

(33) If it is determined that something is wrong with the first braking device **110** in the step S**210**, the control unit **150** may control an electronic parking brake mounted on the rear wheels so that the electronic parking brake applies a braking force to the rear wheels (S**220**). The second braking device **120** supplies hydraulic pressure to the front wheel brakes w**3** and w**4** by supplementing some of the functions of the first braking device **110**, and the electronic parking brake supplies hydraulic pressure to the rear wheel brakes w**1** and w**2** by supplementing other functions of the first

braking device **110**.
(34) According to the control method according to an embodiment of the present disclosure, if something is wrong with the first braking device **110**, the second braking device **120** and/or the electronic parking brake may produce a required braking force. Moreover, in the event of a double failure where the first braking device **110** and part of the components of the second braking device **120** fail, part of the components of the first braking device **110** and the second braking device **120** may be controlled so that the electronic brake for the vehicle produces the required braking force.
(35) FIG. **3** is a block diagram schematically showing a configuration of an electronic brake for a vehicle according to an embodiment of the present disclosure.
(36) The electronic brake for a vehicle according to an embodiment of the present disclosure may be an electronic brake for a vehicle that is controlled by the above-described control method. Thus, redundant description will be omitted.
(37) Referring to FIGS. **1** and **3**, the electronic brake for a vehicle includes all or part of a first braking device **110**, a second braking device **120**, and a control unit **150**. The first braking device **110** is configured to supply hydraulic pressure to the wheel brakes w**1** to w**4**. The second braking device **120** is connected between at least part of the wheel brakes w**1** to w**4** and the first braking device **110**. The first braking device **110** may include a master cylinder **111** having a piston **111***a* configured to be pressed along with a brake pedal **112**. The first braking device **110** may include a switch valve unit **115**. The switch valve unit **115** is mounted on a flow path connecting the inside of the master cylinder **111** and an oil reservoir **130**. The second braking device **120** includes a pump **121**. When the brake pedal **112** is pressed a predetermined distance or greater, the oil reservoir **130** and an outlet of the pump **121** are fluidically disconnected. The control unit **150** controls the first braking device **110** and the second braking device **120**. The second braking device **120** includes a blocking valve unit **125** connected between the oil reservoir **130** and the outlet of the pump **121**.
(38) The control unit **150** includes a first determining unit **153**, a second determining unit **154**, a first controller **151**, and a second controller **152**. According to an exemplary embodiment of the present disclosure, the control unit **150** may include a processor (e.g., computer, microprocessor, CPU, ASIC, circuitry, logic circuits, etc.) and an associated non-transitory memory storing software instructions which, when executed by the processor, provides the functionalities of the first determining unit **153**, the second determining unit **154**, the first controller **151**, and the second controller **152**. Herein, the memory and the processor may be implemented as separate semiconductor circuits. Alternatively, the memory and the processor may be implemented as a single integrated semiconductor circuit. The processor may embody one or more processor(s).
(39) The first determining unit **153** determines whether something is wrong with the first braking device **110**. The first determining unit **153** may determine whether something is wrong with the first braking device **110**, based on pressure information and the like received from a pressure sensor or the like of the first braking device **110**. Upon determining that something is wrong with the first braking device **110**, the first determining unit **153** sends a first failure signal.
(40) The second determining unit **154** receives the first failure signal. Upon receiving the failure signal, the second determining unit **154** determines whether something is wrong with the blocking valve unit **125**. Specifically, the second determining unit **154** may determine whether the blocking valve unit **125** gets stuck while opening. The second determining unit **154** may determine whether something is wrong with the blocking valve unit **125**, by using a pressure measurement from a pressure sensor (not shown) mounted on a flow path of the blocking valve unit **125** on the side of the first braking device **110**. Upon determining that something is wrong with the blocking valve unit **125**, the second determining unit **154** may send a second failure signal.
(41) The first controller **151** controls the first braking device **110**. When the first controller **151** receives a blocking valve failure signal, the first controller **151** may control the first braking device **110** so that a flow path on the first braking device **110** connecting the oil reservoir **130** and the outlet of the pump **121** is closed. Specifically, the first controller **151** may control the first braking

device **110** in such a way that the switch valve unit **115** is opened.
(42) The second controller **152** controls the second braking device **120**. The second controller **152** may include a third determining unit **152***a*. Upon receiving the first failure signal and/or the second failure signal, the third determining unit **152***a* determines whether the braking force applied to the vehicle by the electronic brake for the vehicle needs to be increased. If the third determining unit **152***a* determines that the braking force needs to be increased, the second controller **152** controls the inlet flow valve unit **126** to open and drives the pump. Here, the inlet flow valve unit **126** is a valve that is mounted on a flow path connecting the oil reservoir **130** and an inlet of the pump **121**.
(43) With this configuration, the electronic brake for a vehicle according to an embodiment of the present disclosure is able to produce a braking force stably even in the event of a failure where the blocking valve unit **125** gets stuck.
(44) An electronic brake for a vehicle and a control method therefor according to an embodiment of the present disclosure have the effect of generating a braking force required to safely run the vehicle even if something is wrong with a main brake device, by controlling an auxiliary brake device, which generates a required braking force by serving as a backup for the main brake device.
(45) Furthermore, an electronic brake for a vehicle and a control method therefor according to an embodiment of the present disclosure have the effect of generating a braking force required to safely run the vehicle in a double failure situation, by controlling the main brake device by a control unit so that the main brake device delivers a hydraulic pressure formed by the auxiliary brake device to wheel brakes if something is wrong with the main brake device and the auxiliary brake device.
(46) Although exemplary embodiments of the present disclosure have been described for illustrative purposes, those skilled in the art will appreciate that various modifications, additions, and substitutions are possible, without departing from the idea and scope of the claimed invention. Therefore, exemplary embodiments of the present disclosure have been described for the sake of brevity and clarity. The scope of the technical idea of the present embodiments is not limited by the illustrations. Accordingly, one of ordinary skill would understand the scope of the claimed invention is not to be limited by the above explicitly described embodiments but by the claims and equivalents thereof.

Claims

1. A control method for an electronic brake for a vehicle, the electronic brake comprising a first braking device configured to supply hydraulic pressure to wheel brakes, a second braking device including a pump, that is connected between at least part of the wheel brakes and the first braking device and configured to fluidically disconnect an oil reservoir and an outlet of the pump when a brake pedal is pressed a predetermined distance or greater, and a control unit including a first controller for controlling the first braking device and a second controller for controlling the second braking device, the method comprising: determining, by the control unit, whether something is wrong with the first braking device; based on a determination that something is wrong with the first braking device, determining, by the control unit, whether something is wrong with a blocking valve unit mounted to the second braking device and connected between the oil reservoir and the outlet of the pump; and based on a determination that something is wrong with the blocking valve unit, controlling the first braking device by the first controller so that a flow path on the first braking device connecting the oil reservoir and the outlet of the pump is closed, wherein the determining of whether something is wrong with the blocking valve unit comprises determining whether the blocking valve unit gets stuck while opening so that a fluid pressurized in the second braking device leaks into the oil reservoir.
2. The control method of claim 1, wherein the controlling of the first braking device by the first controller further comprises: determining, by the first controller, whether a driver is pressing the

brake pedal; and based on a determination that the driver is pressing the brake pedal, controlling the first braking device by the first controller so as to reduce a hydraulic pressure in a master cylinder.

3. The control method of claim 2, wherein the controlling of the first braking device by the first controller so as to reduce a hydraulic pressure in a master cylinder comprises controlling, by the first controller, a switch valve unit mounted on a flow path connecting the inside of the master cylinder and the oil reservoir so that the switch valve unit is opened.

4. The control method of claim 1, further comprising: determining, by the control unit, whether a braking force applied to the vehicle by the electronic brake for the vehicle needs to be increased, after the controlling of the first braking device by the first controller; based on a determination that the braking force needs to be increased, controlling, by the second controller, an inlet flow valve mounted on a flow path connecting the oil reservoir and an inlet of the pump so that the inlet flow valve is opened; and controlling the pump by the second controller so that the pump pressurizes fluid.

5. The control method of claim 4, further comprising, based on a determination that the braking force does not need to be increased, controlling open and closed states of an inlet valve unit and an outlet valve unit by the second controller, the inlet valve unit being mounted on a flow path connecting the wheel brakes connected to the second braking device and the outlet of the pump, and the outlet valve unit being mounted between the wheel brakes connected to the second braking device and the oil reservoir.

6. The control method of claim 1, further comprising, based on a determination that there is not anything wrong with the blocking valve unit, controlling the second braking device by the second controller so that the second braking device generates a hydraulic pressure equivalent to a required braking force.

7. The control method of claim 6, wherein the controlling of the second braking device by the second controller comprises controlling the blocking valve unit by the second controller so that the blocking valve unit is closed.

8. The control method of claim 1, further comprising, based on determining that something is wrong with the first braking device, controlling an electronic parking brake mounted on rear wheels by the controller unit so that the electronic parking brake applies a braking force to the rear wheels.

9. An electronic brake for a vehicle, the electronic brake comprising a first braking device configured to supply hydraulic pressure to wheel brakes, a second braking device including a pump, that is connected between at least part of the wheel brakes and the first braking device and configured to fluidically disconnect an oil reservoir and an outlet of the pump when a brake pedal is pressed a predetermined distance or greater, and a control unit for controlling the first braking device and the second braking device, the control unit comprising: a first determining unit configured to determine whether something is wrong with the first braking device; a second determining unit configured to determine, based on a determination that something is wrong with the first braking device, whether something is wrong with a blocking valve unit mounted to the second braking device and connected between the oil reservoir and the outlet of the pump; a first controller configured to control, based on a determination that something is wrong with the blocking valve unit, the first braking device so that a flow path on the first braking device connecting the oil reservoir and the outlet of the pump is closed; and a second controller configured to control the second braking device so that the second braking device generates a required braking force, wherein the first controller determines whether the blocking valve unit gets stuck while opening so that a fluid pressurized in the second braking device leaks into the oil reservoir.

10. The electronic brake of claim 9, wherein the first braking device includes a switch valve unit mounted on a flow path connecting an inside of a master cylinder and the oil reservoir, the master cylinder having a piston configured to be pressed along with the brake pedal, and wherein, based

on a determination that something is wrong with the blocking valve unit, the first controller controls the switch valve unit to open.

11. The electronic brake of claim 9, wherein the second braking device includes an inlet flow valve unit mounted on a flow path connecting the oil reservoir and an inlet of the pump, and the second controller includes a third determining unit configured to determine whether the braking force applied to the vehicle by the electronic brake for the vehicle needs to be increased, and wherein, based on a determination by the third determining unit that the braking force needs to be increased, the second controller controls the inlet flow valve unit to open and drives the pump.