CLAIMS

What is claimed is:

1. A direct current (DC) load response control method, comprising:

monitoring a utilization voltage of the DC load;

determining whether the utilization voltage is in a response range, wherein the response range is one of a plurality of operation ranges divided according to a proportional value of a rated voltage on a power supply side or a voltage difference with the rated voltage; the plurality of operation ranges further comprises a protection range, an isolation range, and a normal operation range; and a load control solution corresponding to the protection range comprises shutdown protection; a load control solution corresponding to the isolation range comprises controlling the load to operate normally; a load control solution corresponding to the normal operation range comprises controlling the load to operate normally without responding; and

controlling an operation of the DC load according to a determination result and a type of the DC load; wherein the controlling the operation of the DC load according to the determination result and the type of the DC load comprises:

when the DC load is a transferable power load,

if the determination result indicates that the utilization voltage is in the response range, controlling the DC load to enter an operation waiting state and determining whether a waiting time is greater than a first set time, and if the waiting time is greater than the first set time, controlling the DC load to enter an operation state; and

if the determination result indicates that the utilization voltage is not in the response range and not in the protection range,

controlling the DC load to operate normally, or

determining whether a duration in which the utilization voltage is in the normal operation range is greater than a second set time, if the duration is greater than the second set time, controlling the DC load to start the normal

operation, and if the duration is not greater than the second set time, controlling the DC load to enter the operation waiting state;

when the DC load is a fixed power load,

if the determination result indicates that the utilization voltage is in the response range, determining whether an utilization power of the DC load is greater than a set power,

if the utilization power is greater than the set power, controlling the DC load to stop operating; and

if the utilization power is not greater than the set power, controlling the DC load to operate normally, or controlling the DC load to stop operating or operate intermittently according to a set importance level of the DC load; and

if the determination result indicates that the utilization voltage is not in the response range and not in the protection range, controlling the DC load to operate normally.

2. The method according to claim 1, further comprising:

categorizing the DC loads in a network according to a startup operation characteristic of each DC load in the network before monitoring the utilization voltage of the DC load.

~~3. The method according to claim 1 or 2, wherein the type of the DC load comprises an adjustable power load, a transferable power load, or a fixed power load.~~

~~4. The method according to claim 1, wherein:~~

~~the response range is one of a plurality of operation ranges divided according to a proportional value of a rated voltage on a power supply side or a voltage difference with the rated voltage; and~~

a load control solution corresponding to the response range comprising controlling the DC load whether to operate or adjusting an operating parameter of the DC load according to a voltage change parameter, wherein each operation range corresponds to one load control solution.

5. The method according to claim 4, wherein:

the plurality of operation ranges further comprises a protection range, an isolation range, and a normal operation range; and

a load control solution corresponding to the protection range comprises shutdown protection; a load control solution corresponding to the isolation range comprises controlling the load to operate normally and controlling the load to prepare for a response; a load control solution corresponding to the normal operation range comprises controlling the load to operate normally without responding.

6. The method according to claim 1, wherein:

when the DC load is an adjustable power load, the controlling the operation of the DC load comprises: adjusting a power of the DC load according to the utilization voltage.

7. The method according to claim 1, wherein the controlling the operation of the DC load according to the determination result and the type of the DC load comprises:

when the DC load is an adjustable power load,

if the determination result indicates that the utilization voltage is in the response range, controlling an operating parameter of the DC load to decrease or increase according to a preset corresponding relationship between a voltage and the operating parameter; and

if the determination result indicates that the utilization voltage is not in the response range and not in the protection range, controlling the DC load to operate normally

~~without responding.~~

~~8. The method according to claim 1, wherein:~~

~~when the DC load is a transferable power load, the controlling the operation of the DC load comprises: controlling the DC load to operate when a duration of voltage stabilization exceeds a predetermined time length.~~

~~9. The method according to claim 1, wherein the controlling the operation of the DC load according to the determination result and the type of the DC load comprises:~~

~~when the DC load is a transferable power load,~~

~~if the determination result indicates that the utilization voltage is in the response range, controlling the DC load to enter an operation waiting state and determining whether a waiting time is greater than a first set time, and if the waiting time is greater than the first set time, controlling the DC load to enter an operation state; and~~

~~if the determination result indicates that the utilization voltage is not in the response range and not in the protection range,~~

~~controlling the DC load to operate normally, or~~

~~determining whether a duration in which the utilization voltage is in the normal operation range is greater than a second set time, if the duration is greater than the second set time, controlling the DC load to start the normal operation, and if the duration is not greater than the second set time, controlling the DC load to enter the operation waiting state.~~

~~10. The method according to claim 1, wherein:~~

~~when the DC load is a fixed power load, the controlling the operation of the DC load comprises: controlling the DC load to intermittently operate or stop operating.~~

~~11. The method according to claim 1, wherein the controlling the operation of the DC load according to the determination result and the type of the DC load comprises:~~

~~when the DC load is a fixed power load,~~

~~if the determination result indicates that the utilization voltage is in the response range, determining whether an utilization power of the DC load is greater than a set power;~~

~~if the utilization power is greater than the set power, controlling the DC load to stop operating; and~~

~~if the utilization power is not greater than the set power, controlling the DC load to operate normally, or controlling the DC load to stop operating or operate intermittently according to a set importance level of the DC load;~~

~~and~~

~~if the determination result indicates that the utilization voltage is not in the response range and not in the protection range, controlling the DC load to operate normally.~~

~~12~~3. The method according to ~~any one of claims 1 to 11~~claim 1, wherein the monitoring the utilization voltage of the DC load comprises:

monitoring the utilization voltage of the DC load by using a sampling circuit in the DC load.

~~13~~4. A direct current (DC) load response control apparatus, comprising:

a monitoring module, configured to monitor a utilization voltage of the DC load;

a determination module, configured to determine whether the utilization voltage is in a response range, wherein the response range is one of a plurality of operation ranges divided according to a proportional value of a rated voltage on a power supply side or a voltage difference with the rated voltage the plurality of operation ranges further comprises a protection range, an isolation range, and a normal operation range; and a load

control solution corresponding to the protection range comprises shutdown protection; a load control solution corresponding to the isolation range comprises controlling the load to operate normally; a load control solution corresponding to the normal operation range comprises controlling the load to operate normally without responding; and

a control module, configured to control an operation of the DC load according to a determination result and a type of the DC load; wherein

when the DC load is a transferable power load,

if the determination result indicates that the utilization voltage is in the response range, the control module is configured to control the DC load to enter an operation waiting state and determine whether a waiting time is greater than a first set time, and if the waiting time is greater than the first set time, control the DC load to enter an operation state; and

if the determination result indicates that the utilization voltage is not in the response range and not in the protection range, the control module is configured to:

control the DC load to operate normally, or

determine whether a duration in which the utilization voltage is in the normal operation range is greater than a second set time, if the duration is greater than the second set time, control the DC load to start the normal operation, and if the duration is not greater than the second set time, control the DC load to enter the operation waiting state;

when the DC load is a fixed power load,

if the determination result indicates that the utilization voltage is in the response range, the control module is configured to determine whether an utilization power of the DC load is greater than a set power,

if the utilization power is greater than the set power, the control module is configured to control the DC load to stop operating; and

if the utilization power is not greater than the set power, the control

module is configured to control the DC load to operate normally, or control the DC load to stop operating or operate intermittently according to a set importance level of the DC load; and

if the determination result indicates that the utilization voltage is not in the response range and not in the protection range, the control module is configured to control the DC load to operate normally.

5. The apparatus of claim 4, further comprising a categorization module, configured to categorize the DC load in a network according to a startup operation characteristic of each DC load in the network before monitoring the utilization voltage of the DC load.

6. The apparatus of claim 4, wherein the monitoring module is configured to monitor the utilization voltage of the DC load by using a sampling circuit in the DC load.

~~14~~7. A direct current (DC) load response control apparatus, comprising:

a memory; and

a processor coupled to the memory, the processor being configured to execute the method according to any one of claims 1 to ~~12~~ 3 based on instructions stored in the memory.

~~15~~8. A direct current (DC) electric appliance, comprising the DC load response control apparatus according to ~~claim 13 or 14~~any one of claims 4-7.

~~16~~9. A computer-readable storage medium with a computer program stored thereon, wherein the program, when executed by a processor, implements the DC load response control method according to any one of claims 1 to ~~12~~3.