CLAIMS

WHAT IS CLAIMED IS:

[Claim 1]

A battery management system, comprising:

a temperature sampling circuit, configured to obtain a temperature parameter of a plurality of battery packs;

a plurality of voltage measurement circuits, respectively coupled to the battery packs and configured to obtain a plurality of open circuit voltage parameters of the battery packs;

a current sampling circuit, coupled to the battery packs and configured to obtain a current parameter of the battery packs;

a microcontroller, coupled to the voltage measurement circuits, the current sampling circuit, and the temperature sampling circuit;

a protection circuit, coupled to the battery packs and the microcontroller; and

a plurality of balance circuits, respectively coupled to the battery packs and the microcontroller,

wherein the microcontroller is configured to obtain a plurality of initial state-of-charge parameters of the battery packs according to the open circuit voltage parameters and the temperature parameter and respectively configured to calculate a plurality of present battery powers of the battery packs according to the initial state-of-charge parameters, the temperature parameter, and the current parameter,

wherein the microcontroller is configured to use the open circuit voltage parameters and the temperature parameter to search a battery parameter table to obtain the initial state-of-charge parameters,

wherein a corresponding battery equivalence model of the battery packs is to be

constructed by battery data, the battery data is to be generated by a hybrid pulse power characterization test in advance, and the battery parameter table is to be established by inputting a plurality of battery model parameters corresponding to different temperatures into the battery equivalence model,

wherein the microcontroller is configured to obtain a plurality of voltage parameters of the battery packs through the voltage measurement circuits,

wherein when the microcontroller judges that at least one of the battery packs is in an overvoltage state according to the voltage parameters, the microcontroller operates the protection circuit to break the charge loop of the battery packs, and the microcontroller operates at least one of the corresponding balance circuits to perform a battery balance operation on the at least one of the battery packs,

wherein when the microcontroller judges the voltage parameters reach a high voltage resetting value through the voltage measurement circuits, the microcontroller ends the battery balance operation, and operates the protection circuit to reset the charge loop of the battery packs.

[Claim 2]

The battery management system according to claim 1, wherein when the temperature sampling circuit obtains an another temperature parameter of a next timepoint, the microcontroller updates the initial state-of-charge parameters of the battery packs according to the open circuit voltage parameters and the another temperature parameter and recalculates the present battery powers of the battery packs according to the updated initial state-of-charge parameters.

[Claim 3]

The battery management system according to claim 1,

wherein when the microcontroller judges that the battery packs are in an abnormal temperature state according to the temperature parameter, the microcontroller operates the protection circuit to break a charge/discharge loop of the battery packs.

[Claim 4]

The battery management system according to claim 1, wherein when the microcontroller judges that the battery packs are in an overcurrent state according to the current parameter, the microcontroller judges that the battery packs are performing a charge operation or a discharge operation according to the current parameter, and the microcontroller operates the protection circuit to break the charge loop or the discharge loop of the battery packs.

[Claim 5]

The battery management system according to claim 1, wherein when the microcontroller judges that at least one of the battery packs is in a low voltage state according to the voltage parameters, the microcontroller operates the protection circuit to break the discharge loop of the battery packs, and the microcontroller corrects the initial state-of-charge parameters corresponding to the at least one of the battery packs.

[Claim 6]

The battery management system according to claim 1, wherein the microcontroller is configured to obtain a plurality of present voltage parameters of the battery packs through the voltage measurement circuits, and the microcontroller is configured to obtain a present current parameter of the battery packs through the current sampling circuit, and

wherein when the microcontroller judges that the present voltage parameters reach a

cut-off voltage and the present current parameter reaches a cut-off current, the microcontroller operates the protection circuit to break the charge loop of the battery packs and corrects the initial state-of-charge parameters corresponding to the battery packs.

[Claim 7]

The battery management system according to claim 1, wherein when the microcontroller judges that the battery packs are left static for a predetermined time duration, the microcontroller corrects the initial state-of-charge parameters corresponding to the battery packs.

[Claim 8]

The battery management system according to claim 1, wherein the battery packs respectively comprise a plurality of aluminum-ion batteries connected in series.

[Claim 9]

A battery management method, comprising:

obtaining a temperature parameter of a plurality of battery packs through a temperature sampling circuit;

obtaining a plurality of open circuit voltage parameters of the battery packs through a plurality of voltage measurement circuits;

obtaining a plurality of initial state-of-charge parameters of the battery packs through a microcontroller according to the open circuit voltage parameters and the temperature parameter;

obtaining a current parameter of the battery packs through a current sampling circuit;

respectively calculating a plurality of present battery powers of the battery packs through the microcontroller according to the initial state-of-charge parameters, the temperature parameter, and the current parameter,

obtaining a plurality of voltage parameters of the battery packs through the voltage measurement circuits;

when the microcontroller judges that at least one of the battery packs is in an overvoltage state according to the voltage parameters, operating a protection circuit through the microcontroller to break the charge loop of the battery packs;

operating at least one of a plurality of corresponding balance circuits coupled to the battery packs through the microcontroller to perform a battery balance operation on the at least one of the battery packs; and

when the microcontroller judges the voltage parameters reach a high voltage resetting value through the voltage measurement circuits, ending the battery balance operation by the microcontroller, and operating the protection circuit through the microcontroller to reset the charge loop of the battery packs,

wherein obtaining the open circuit voltage parameters of the battery packs comprises:

searching a battery parameter table using the open circuit voltage parameters and the temperature parameter through the microcontroller to obtain the initial state-of-charge parameters,

wherein a corresponding battery equivalence model of the battery packs is constructed by battery data, the battery data is generated by a hybrid pulse power characterization test in advance, and the battery parameter table is established by inputting a plurality of battery model parameters corresponding to different temperatures into the battery equivalence model.

[Claim 10]

The battery management method according to claim 9, further comprising:

when the temperature sampling circuit obtains an another temperature parameter of a next timepoint, updating the initial state-of-charge parameters of the battery packs through the

microcontroller according to the open circuit voltage parameters and the another temperature parameter; and

recalculating the present battery powers of the battery packs through the microcontroller according to the updated initial state-of-charge parameters.

[Claim 11]

The battery management method according to claim 9, further comprising:

when the microcontroller judges that the battery packs are in an abnormal temperature state according to the temperature parameter, operating the protection circuit coupled to the battery packs through the microcontroller to break a charge/discharge loop of the battery packs.

[Claim 12]

The battery management method according to claim 9, further comprising:

when the microcontroller judges that the battery packs are in an overcurrent state according to the current parameter, judging whether the battery packs are performing a charge operation or a discharge operation through the microcontroller according to the current parameter, and operating the protection circuit to break the charge loop or the discharge loop of the battery packs.

[Claim 13]

The battery management method according to claim 9, further comprising:

when the microcontroller judges that at least one of the battery packs is in a low voltage state according to the voltage parameters, operating the protection circuit through the microcontroller to break the discharge loop of the battery packs; and

correcting the initial state-of-charge parameters corresponding to the at least one of the battery packs through the microcontroller.

[Claim 14]

The battery management method according to claim 9, further comprising:

obtaining a plurality of present voltage parameters of the battery packs through the voltage measurement circuits;

obtaining a present current parameter of the battery packs through the current sampling circuit;

when the microcontroller judges that the present voltage parameters reach a cut-off voltage and the present current parameter reaches a cut-off current, operating the protection circuit through the microcontroller to break the charge loop of the battery packs; and

correcting the initial state-of-charge parameters corresponding to the battery packs through the microcontroller.

[Claim 15]

The battery management method according to claim 9, further comprising:

when the microcontroller judges that the battery packs are left static for a predetermined time duration, correcting the initial state-of-charge parameters corresponding to the battery packs through the microcontroller.

[Claim 16]

The battery management method according to claim 9, wherein the battery packs respectively comprise a plurality of aluminum-ion batteries connected in series.