

CLAIMS

1. A method of operating an electric power system comprising:
determining a charge state of a first battery unit and a charge state of a second battery unit;
determining a difference between the charge state of the first battery unit and the charge state of the second battery unit;
determining whether to enable discharging simultaneously of both the first battery unit and the second battery unit, or to enable discharging of one of the first battery unit and the second battery unit, based on the difference between the charge state of the first battery unit and the charge state of the second battery unit,
wherein at least one of the first battery unit and the second battery unit is a swappable battery unit.
2. The method of claim 1, further comprising:
determining the difference comprises determining a lower charge state and a higher charge state among the first battery unit and the second battery unit.
3. The method of claim 2, further comprising:
comparing the difference between the higher charge state and the lower charge state with a first pre-determined charge difference to obtain a first comparison result; and
determining whether to enable discharging simultaneously of both the first battery unit and the second battery unit, or to enable discharging of one of the first battery unit and the second battery unit, based on the first comparison result.
4. The method of claim 3, further comprising:
the first comparison result indicating that the difference between the higher charge state and the lower charge state is lower than the first pre-determined charge difference, and
enabling discharging simultaneously of both the first battery unit and the second battery unit.
5. The method of claim 3, further comprising:

the first comparison result indicating that the difference between the higher charge state and the lower charge state is higher than or equal to the first pre-determined charge difference, and

enabling discharging of one of the battery unit of the first battery unit and the second battery unit with the higher charge state, and disabling discharging of the battery unit of the first battery unit and the second battery unit with the lower charge state.

6. The method of any one of claims 2 to 5, further comprising:

comparing the difference between the higher charge state and the lower charge state with a second pre-determined charge difference to obtain a second comparison result; and

determining whether to enable charging of both the first battery unit and the second battery unit, or enable charging of one of the first battery unit and the second battery unit, based on the second comparison result.

7. The method of claim 6, further comprising:

the second comparison result indicating that the difference between the higher charge state and the lower charge state among the first battery unit and the second battery unit is lower than the second pre-determined charge difference, and

enabling charging of both the first battery unit and the second battery unit.

8. The method of claim 6, further comprising:

the second comparison result indicating that the difference between the higher charge state and the lower charge state among the first battery unit and the second battery unit is higher or equal than the second pre-determined charge difference, and

enabling charging of the battery unit of the first battery unit and the second battery unit with the lower charge state, and disabling charging of the battery unit of the first battery unit and the second battery unit with the higher charge state.

9. The method of any one of claims 1 to 8, further comprising:

detecting a fault of the electric power system, and

disabling charging of both the first battery unit and the second battery unit.

10. The method of claim 9, further comprising:
detecting the fault of the electric power system when:
a temperature of the electric power system is above a pre-determined temperature threshold; or
failing to detect both the charge state of the first battery unit and the charge state of the second battery unit; or
both of the above are satisfied.
11. The method of any one of claims 1 to 10, wherein the charge state is determined by measuring voltage of a battery unit.
12. The method of any one of claims 1 to 11, wherein enabling discharging comprises sending a discharge enable command from a power control circuit of the electric power system to the respective battery unit; and
wherein disabling discharging comprises sending a discharge disable command from the power control circuit to the respective battery unit.
13. The method of any one of claims 1 to 11, wherein enabling charging comprises sending a charge enable command from a power control circuit of the electric power system to of the respective battery unit; and
wherein disabling charging comprises sending a charge disable command from the power control circuit to the respective battery unit.
14. The method of any one of claims 1 to 13, wherein each of the first battery unit and the second battery unit is a swappable battery unit.
15. An electric power system comprising:
a first electrical connection for connecting with a first battery unit;
a second electrical connection for connecting with a second battery unit;
a power control circuit comprising a microprocessor in communication with the first battery unit and the second battery unit when these are connected, the processor configured to:

determine a charge state of the first battery unit and a charge state of the second battery unit;

determine a difference between the charge state of the first battery unit and the charge state of the second battery unit;

determine whether to enable discharging simultaneously of both the first battery unit and the second battery unit, or to enable discharging of one of the first battery unit and the second battery unit, based on the difference between the charge state of the first battery unit and the charge state of the second battery unit;

wherein at least one of the first battery unit and the second battery unit is a swappable battery unit.

16. The electric power system of claim 15, wherein each of the first battery unit and the second battery unit is a swappable battery unit.

17. The electric power system of claim 15 or claim 16, wherein the charge state is determined by measuring voltage of a battery unit.

18. The electric power system of any one of claims 15 to 17, wherein enabling discharging comprises sending a discharge enable command from a power control circuit of the electric power system to one of the first battery unit and the second battery unit; and

wherein disabling discharging comprises sending a discharge disable command from the power control circuit to one of the first battery unit and the second battery unit.

19. The electric power system of any one of claims 15 to 17, wherein enabling charging comprises sending a charge enable command from a power control circuit of the electric power system to one of the first battery unit and the second battery unit; and

wherein disabling charging comprises sending a charge disable command from the power control circuit to one of the first battery unit and the second battery unit.

20. The electric power system of any one of claims 15 to 19, further comprising the first and the second battery units.

21. The electric power system of claim 20, wherein each of the first and second battery units is configured to detect a communication error, and to turn off a respective output when the communication error is detected.
22. An electric vehicle comprising an electric power system according to any of the claims 15 to 21.
23. A computer executable code comprising instructions for operating an electric power system according to the method of any of claims 1 to 14.