power adjustment unit may be configured to receive the voltage feedback signal and the current feedback signal and stabilize the output voltage and output current of the adapter when the voltage feedback signal indicates the output voltage of the adapter has reached the set target voltage or the current feedback signal indicates the output current of the adapter has reached the set target current, wherein the voltage value of the set target voltage and the current value of the set target current are adjusted in real time based on the status information of the battery.

[0005] According to a second aspect, a method for charging control implemented by an adapter includes: converting an input alternating current (AC) to obtain an output voltage and output current of the adapter; detecting the output voltage of the adapter to generate a voltage feedback signal that indicates whether the output voltage of the adapter reaches a set target voltage; detecting the output current of the adapter to generate a current feedback signal indicating whether the output current of the adapter reaches a set target current; and stabilizing the output voltage and output current of the adapter when the voltage feedback signal indicates the output voltage of the adapter has reached the set target voltage or the current feedback signal indicates the output current of the adapter has reached the set target current, wherein the voltage value of the set target voltage and the current value of the set target current are adjusted in real time based on the status information of the battery.

[0006] The adapter according to the embodiments includes both a voltage feedback unit and a current feedback unit. The voltage feedback unit, power adjustment unit, and power conversion unit altogether form a hardware circuit that exerts closed-loop control of the adapter’s output voltage, i.e., realizing a hardware voltage feedback loop. The current feedback unit, power adjustment unit, and power conversion unit altogether form a hardware circuit that exerts closed-loop control over the adapter’s output current, i.e., realizing a hardware current feedback loop. Thus relying on the double-loop feedback control, the power adjustment unit may take into account the feedback information provided by both the voltage feedback signal and the current feedback signal, and would commence to stabilize the output voltage and output current of the adapter when either the output voltage or the output current reaches the respective target value. In other words, once either the output voltage or the output

current of the adapter reaches the target value, the power adjustment unit can immediately sense the occurrence of this event and accordingly make an instant response to the event so as to stabilize the output voltage and output current, which improves the safety of the charging process.

WHAT IS CLAIMED IS:

1. An adapter comprising:

a power conversion unit, configured to convert an input alternating current (AC) to obtain an output voltage and an output current of the adapter;

a voltage feedback unit, having an input end coupled to the power conversion unit, and configured to detect the output voltage of the adapter to generate a voltage feedback signal, the voltage feedback signal being configured to indicate whether the output voltage of the adapter reaches a set target voltage;

a current feedback unit, having an input end coupled to the power conversion unit, and configured to detect the output current of the adapter to generate a current feedback signal, the current feedback signal being configured to indicate whether the output current of the adapter reaches a set target current; and

a power adjustment unit, having an input end coupled to an output end of the voltage feedback unit and to an output end of the current feedback unit, and an output end coupled to the power conversion unit, the power adjustment unit being configured to receive the voltage feedback signal and the current feedback signal and stabilize the output voltage and the output current of the adapter when the voltage feedback signal indicates the output voltage of the adapter has reached the set target voltage or when the current feedback signal indicates the output current of the adapter has reached the set target current, wherein the voltage value of the set target voltage and the current value of the set target current are adjusted in real time based on the status information of the battery.

2. The adapter of claim 1, further comprising a first adjustment unit coupled to the voltage feedback unit to adjust a value of the target voltage.

3. The adapter of claim 2, wherein the voltage feedback unit comprises:

a voltage sampling unit, having an input end coupled to the power conversion unit, and configured to sample the output voltage of the adapter to obtain a first voltage; and

a voltage comparison unit, having an input end coupled to an output end of the voltage sampling unit, and configured to compare the first voltage against a first reference voltage and generate the voltage feedback signal based on the comparison between the first voltage and the first reference voltage;

wherein the first adjustment unit is coupled to the voltage comparison unit to supply the first reference voltage to the voltage comparison unit and is configured to adjust a value of the first reference voltage in order to adjust the value of the target voltage.

4. The adapter of claim 3, wherein the first adjustment unit comprises a control unit, and a first digital-to-analog converter (DAC) having an input end coupled to the control unit and an output end coupled to the voltage comparison unit such that the control unit is operative to adjust the value of the first reference voltage through the first DAC.

5. The adapter of claim 3 or 4, wherein the voltage comparison unit comprises a first operational amplifier (op-amp) having a reversed-phase input end configured to receive the first voltage, an in-phase input end configured to receive the first reference voltage, and an output end configured to generate the voltage feedback signal.

6. The adapter of any of claims 2 to 5, wherein the adapter is operable in a first charging mode and a second charging mode, and the first adjustment unit is operative

to adjust the value of the target voltage based on the first charging mode or the second charging mode currently used by the adapter.

7. The adapter of any of claims 1 to 6, further comprising a second adjustment unit coupled to the current feedback unit to adjust a current value of the target current.

8. The adapter of claim 7, wherein the current feedback unit comprises:

a current sampling unit, having an input end coupled to the power conversion unit, and configured to sample the output current of the adapter to obtain a second voltage, the second voltage being configured to indicate a magnitude of the output current of the adapter; and

a current comparison unit, having an input end coupled to an output end of the current sampling unit, and configured to compare the second voltage against a second reference voltage and generate the current feedback signal based on the comparison between the second voltage and the second reference voltage;

wherein the second adjustment unit is coupled to the current comparison unit to supply the second reference voltage to the current comparison unit and configured to adjust a voltage value of the second reference voltage in order to adjust the current value of the target current.

9. The adapter of claim 8, wherein the second adjustment unit comprises a control unit and a second digital-to-analog converter (DAC) having an input end coupled to the control unit and an output end coupled to the current comparison unit such that the control unit is operative to adjust the voltage value of second reference voltage through the second DAC.

10. The adapter of claim 8 or 9, wherein the current comparison unit comprises a second operational amplifier (op-amp) having a reversed-phase input end configured

to receive the second voltage, an in-phase input end configured to receive the second reference voltage, and an output end configured to generate the current feedback signal.

11. The adapter of any of claims 8 to 10, wherein the adapter is operable in a first charging mode and a second charging mode, and the second adjustment unit is operative to adjust the current value of the target current based on the first charging mode or the second charging mode currently used by the adapter.

12. The adapter of any of claims 1 to 11, wherein the adapter is operable in a first charging mode which is a constant-voltage mode, and wherein in the constant-voltage mode, the target voltage is a voltage corresponding to the constant-voltage mode and the target current is the maximum current the adapter allows to output in the constant-voltage mode;

wherein the power adjustment unit is configured to adjust the output voltage of the adapter to the voltage corresponding to the constant-voltage mode based on the voltage feedback signal, and configured to control the output current of the adapter to not exceed the maximum current the adapter allows to output in the constant-voltage mode when the current feedback signal indicates the output current of the adapter has reached the maximum current.

13. The adapter of claim 12, wherein the power conversion unit comprises a primary rectification unit, a transformer, a secondary rectification unit, and a secondary filter unit, wherein the primary rectification unit is configured to directly output a voltage of a pulsating waveform to the transformer.

14. The adapter of claim 13, wherein the maximum current the adapter allows to output in the constant-voltage mode is determined based on capacity of one or more capacitors in the secondary filter unit.

15. The adapter of any of claims 1 to 14, wherein the adapter is operable in a second charging mode which is a constant-current mode, and in the constant-current mode, the target voltage is the maximum voltage the adapter allows to output in the constant-current mode and the target current is a current corresponding to the constant-current mode;

wherein the power adjustment unit is configured to adjust the output current of the adapter to the current corresponding to the constant-current mode based on the current feedback signal, and control the output voltage of the adapter to not exceed the maximum voltage the adapter allows to output in the constant-current mode when the voltage feedback signal indicates the output voltage of the adapter has reached the maximum voltage.

16. The adapter of any of claims 1 to 15, wherein the voltage feedback unit comprises a first operational amplifier (op-amp) having an output end configured to output the voltage feedback signal, and the current feedback unit comprises a second op-amp having an output end configured to output the current feedback signal;

wherein the power adjustment unit comprises a first diode, a second diode, a photoelectric coupling unit, and a pulse width modulation (PWM) control unit, wherein the output end of the first op-amp of the voltage feedback unit is coupled to a cathode of the first diode, and the first diode has an anode coupled to an input end of the photoelectric coupling unit; wherein the output end of the second op-amp of the current feedback unit is coupled to a cathode of the second diode, and the second

diode has an anode coupled to the input end of the photoelectric coupling unit; wherein the photoelectric coupling unit has an output end coupled to an input end of the PWM control unit, and the PWM control unit has an output end coupled to the power conversion unit.

17. The adapter of any of claims 1 to 16, wherein the adapter is operable in a first charging mode and a second charging mode, and a charging speed of a device to be charged by the adapter in the second charging mode is faster than in the first charging mode, and wherein the adapter comprises a control unit that performs two-way communication with the device to be charged, when the adapter is connected with the device to be charged, to control the output of the adapter in the second charging mode.

18. The adapter of claim 17, wherein performing by the control unit two-way communication with the device to be charged to control the adapter output in the second charging mode comprises:

performing, by the control unit, two-way communication with the device to be charged to negotiate a charging mode between the adapter and the device to be charged.

19. The adapter of claim 17 or 18, wherein performing by the control unit two-way communication with the device to be charged to control the output of the adapter in the second charging mode comprises:

performing, by the control unit, two-way communication with the device to be charged to negotiate an output charging voltage of the adapter that is used to charge the device to be charged in the second charging mode; and

adjusting, by the control unit, the value of the target voltage to be equal to the output charging voltage of the adapter that is used to charge the device to be charged in the second charging mode.

20. The adapter of any of claims 17 to 19, wherein performing by the control unit two-way communication with the device to be charged to control the output of the adapter in the second charging mode comprises:

performing, by the control unit, two-way communication with the device to be charged to determine a charging current that is output by the adapter in the second charging mode and used to charge the device to be charged; and

adjusting, by the control unit, the current value of the target current to be equal to the charging current that is output by the adapter in the second charging mode and is used to charge the device to be charged.

21. The adapter of any of claims 1 to 20, wherein the adapter is operable in a second charging mode which is a constant-current mode, and in the second charging mode, the output current of the adapter is a pulsating direct current (DC).

22. The adapter of claim 21, wherein the adapter is operable in a first charging mode which is a constant-voltage mode, the power conversion unit comprises a secondary filter unit and the adapter comprises a control unit coupled to the secondary filter unit, and wherein in the first charging mode, the control unit is configured to control the secondary filter unit to operate such that a value of the output voltage of the adapter keeps constant, and in the second charging mode, the control unit is configured to control the secondary filter unit to stop operating such that the output current of the adapter becomes a pulsating DC.

23. A method for charging control implemented by an adapter, comprising:

converting an input alternating current (AC) to obtain an output voltage and an output current of the adapter;

detecting the output voltage of the adapter to generate a voltage feedback signal that indicates whether the output voltage of the adapter reaches a set target voltage;

detecting the output current of the adapter to generate a current feedback signal that is configured to indicate whether the output current of the adapter reaches a set target current; and

stabilizing the output voltage and the output current of the adapter when the voltage feedback signal indicates the output voltage of the adapter has reached the target voltage or when the current feedback signal indicates the output current of the adapter has reached the target current, wherein the voltage value of the target voltage and the current value of the target current are adjusted in real time based on the status information of the battery.

24. The method of claim 23, further comprising:

adjusting a value of the target voltage.

25. The method of claim 24, wherein detecting the output voltage of the adapter to generate the voltage feedback signal comprises:

sampling the output voltage of the adapter to obtain a first voltage;

comparing the first voltage against a first reference voltage; and

generating the voltage feedback signal based on the comparison between the first voltage and the first reference voltage;

wherein adjusting the value of the target voltage comprises:

adjusting a value of the first reference voltage to adjust the value of the target voltage.