Abstract

The present invention discloses a Logic Link Control (LLC) resonance converter control method as well as a synchronous rectification control method and device. The LLC resonance converter control method comprises: judging whether a load works at a preset state according to a switch-on frequency of the input switch tube of a LLC resonance circuit; if yes, making the LLC resonance circuit work at a width modulation control mode; otherwise, making the LLC resonance circuit work at a frequency modulation control mode, wherein the preset state includes a light load state or a no load state. The present invention realizes the voltage stabilization when the LLC resonance circuit is in no load or light load condition, reduces the circuit loss, efficiently simplifies the peripheral hardware circuit and is more reliable to be used in comparison with the traditional technical scheme.

Claims

1. A Logic Link Control (LLC) resonance converter control method, characterized by comprising:

judging whether a load works at a preset state according to a switch-on frequency of an input switch tube of a LLC resonance circuit; if yes, making the LLC resonance circuit work at a width modulation control mode; otherwise, making the LLC resonance circuit work at a frequency modulation control mode, wherein the preset state includes a light load state or a no load state.

2. The method according to claim 1, characterized in that before judging whether the load works at the preset state according to the switch-on frequency of the input switch tube of the LLC resonance circuit, the method further comprises:

obtaining a feedback signal of the load; and calculating the switch-on frequency of the input switch tube according to the feedback signal.

3. The method according to claim 2, characterized in that the feedback signal includes at least one of the following: an output voltage and an output current.

4. The method according to claim 2, characterized in that the step of calculating the switch-on frequency of the input switch tube according to the feedback signal comprises:

performing an integral operation on the absolute value of the difference between the feedback signal and a preset value; and then multiplying the result of the integral operation by a certain proportion to obtain the switch-on frequency of the input switch tube.

5. The method according to claim 1, characterized in that the step of judging whether the load works at a preset state according to the switch-on

frequency of the input switch tube of the LLC resonance circuit comprises:

judging whether the switch-on frequency of the input switch tube of the LLC resonance circuit is greater than a preset frequency; if yes, being judged that the load works at the preset state; otherwise, being judged that the load does not work at the preset state.

6. A synchronous rectification control method applied to a LLC resonance circuit which uses the method according to claim 1, characterized by comprising:

judging whether a load works at a preset state according to a switch-on frequency of an input switch tube of the LLC resonance circuit; if yes, switching off the driving of a synchronous tube; otherwise, when the switch-on frequency of the input switch tube is greater than a resonance frequency of the LLC resonance circuit, delaying a switch-on operation of the driving signal of the synchronous tube until a switch-on operation of the driving signal of a power tube, wherein the driving signal of a power tube corresponds to the driving signal of the synchronous tube, and synchronizing a switch-off operation of the driving signal of the synchronous tube with a switch-off operation of the driving signal of the power tube, wherein the preset state includes a light load state or a no load state.

7. The method according to claim 6, characterized by further comprising: when the switch-on frequency of the input switch tube is less than or equal to the resonance frequency of the LLC resonance circuit, delaying the switch-on operation of the driving signal of the synchronous tube until the switch-on operation of the driving signal of the power tube, wherein the driving signal of the power tube corresponds to the driving signal of the synchronous tube, wherein the pulse width of the driving signal of the synchronous tube is a half of a resonance period of the LLC resonance circuit.

8. The method according to claim 6, wherein the step of delaying the switch-on operation of the driving signal of the synchronous tube until the switch-on operation of the driving signal of the power tube, wherein the driving signal of the power tube corresponds to the driving signal of the synchronous tube, comprises: after delaying for a preset time based on the time of switching on the driving signal of the power tube, switching on the driving signal of the synchronous tube, wherein the preset time includes one of the following: a fixed time, and a time which is changed along with the change of a work frequency of the LLC resonance circuit.

9. An LLC resonance converter controller, characterized by comprising:

a judgement module, configured to judge whether a load works at a preset state according to a switch-on frequency of an input switch of a LLC resonance circuit, wherein the preset state includes a light load state or a no load state;

a first judgement module, configured to make the resonance circuit work at a width modulation control mode when the judgment of the judgement module is yes; and

a second adjustment module, configured to make the resonance circuit work at a frequency modulation control mode when the judgement of the judgement module is no.

10. The LLC resonance converter controller according to claim 9, characterized in that the judgement module comprises:

an obtaining sub-module, configured to obtain a feedback signal of the load; and

a calculation sub-module, configured to calculate the switch-on frequency of the input switch tube according to the feedback signal obtained by the obtaining sub-module.

11. A synchronous rectification control device, characterized by comprising:

a judgement module, configured to judge whether a load works at a preset state according to a switch-on frequency of an input switch tube of a LLC resonance circuit, wherein the preset state includes a light load state or a no load state;

a driving switching-off module, configured to switch off a driving of a synchronous tube when the judgment of the judgment module is yes; and

a first driving signal control module, configured to delay a switch-on operation of a driving signal of the synchronous tube until a switch-on operation of a driving signal of a power tube, wherein the driving signal of the power tube corresponds to the driving signal of the synchronous tube, and configure to synchronize a switch-off operation of the driving signal of the synchronous tube with a switch-off operation of the driving signal of the power tube when the judgement of the judgment module is no and the switch-on frequency of the input switch tube is greater than a resonance frequency of the LLC resonance circuit.

12. The device according to claim 11, characterized by further comprising:

a second driving signal control module, configured to delay the switch-on operation of the driving signal of the synchronous tube until the switch-on operation of the driving signal of the power tube when the judgement of the judgment module is no and the switch-on frequency of the input switch tube is less than or equal to the resonance frequency of the LLC resonance circuit, wherein the pulse width of the driving signal of the synchronous tube is a half of a resonance period of the LLC resonance circuit.

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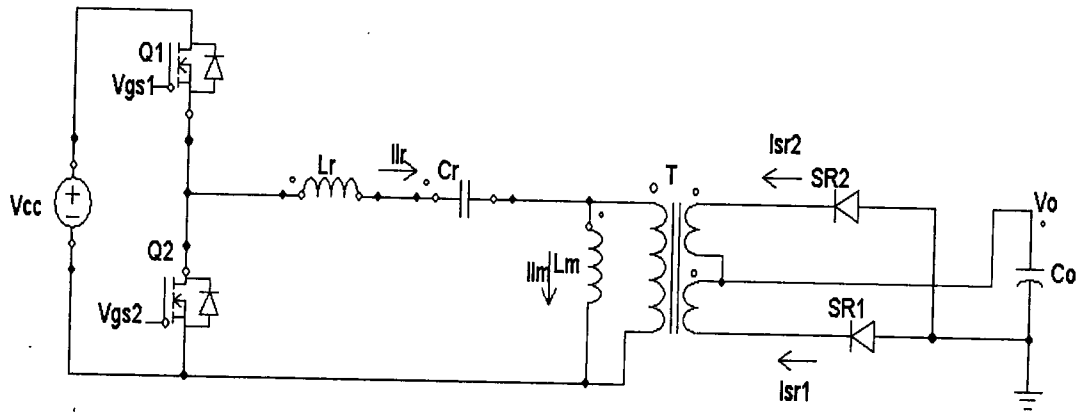

Fig. 1

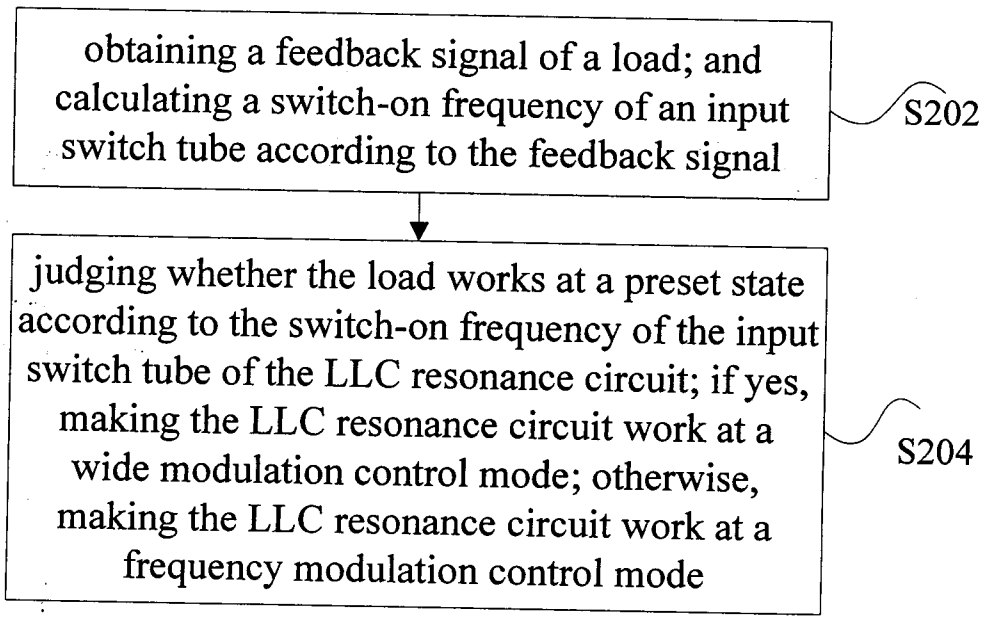

Fig. 2

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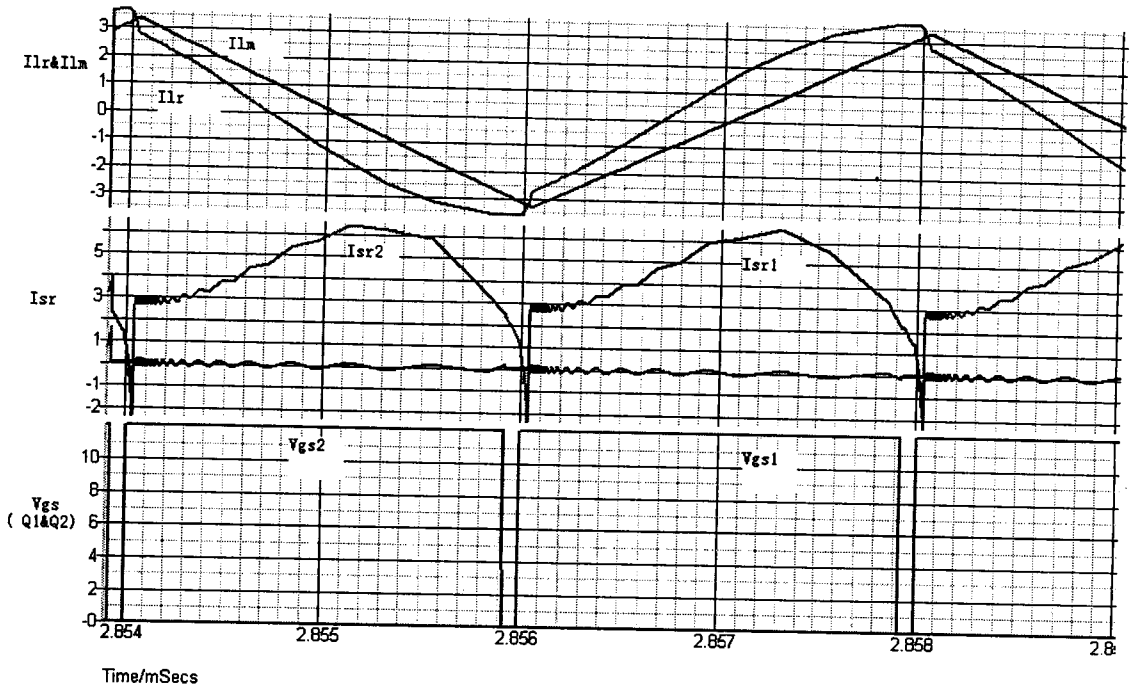

Fig. 3

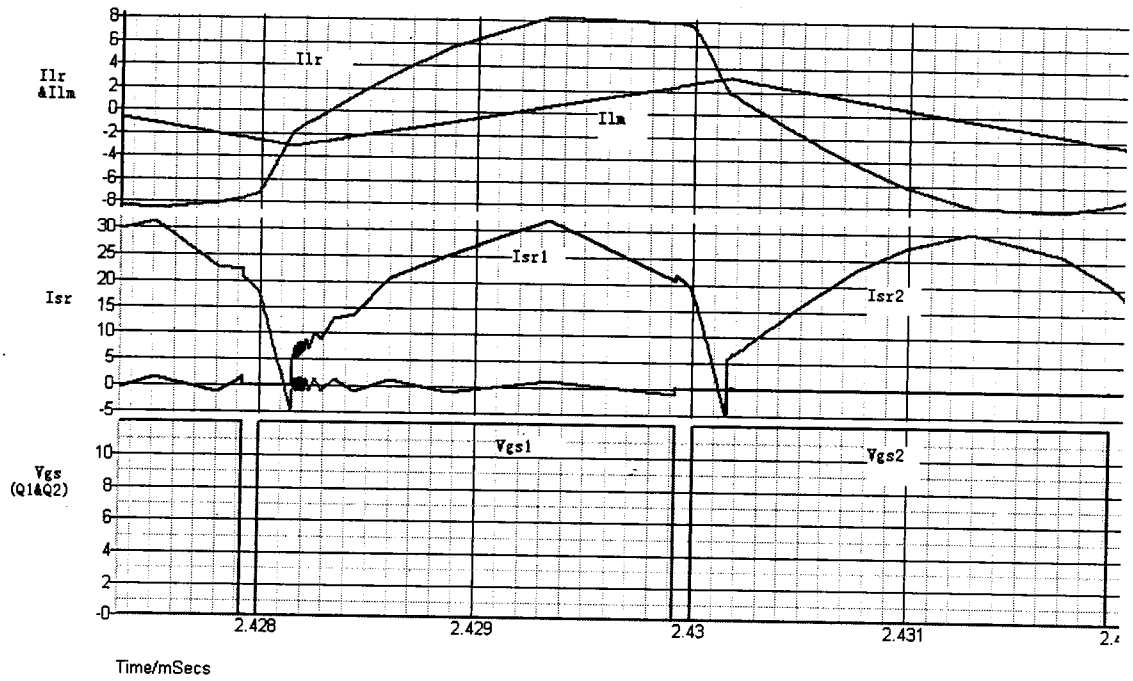

Fig. 4

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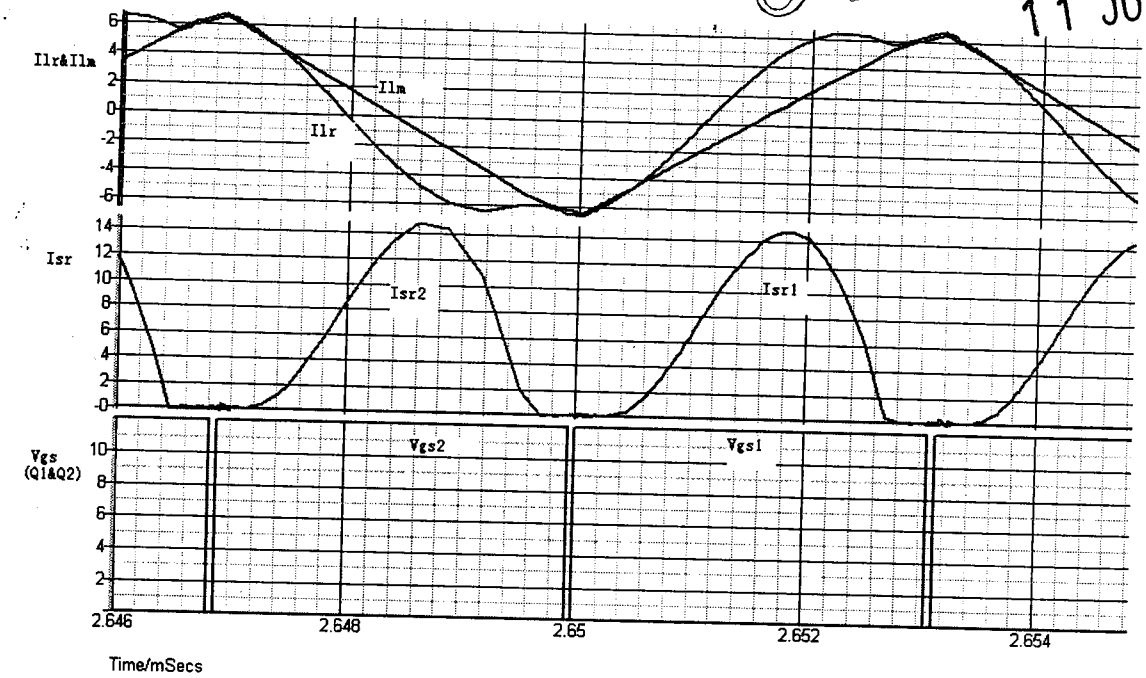

Fig. 5

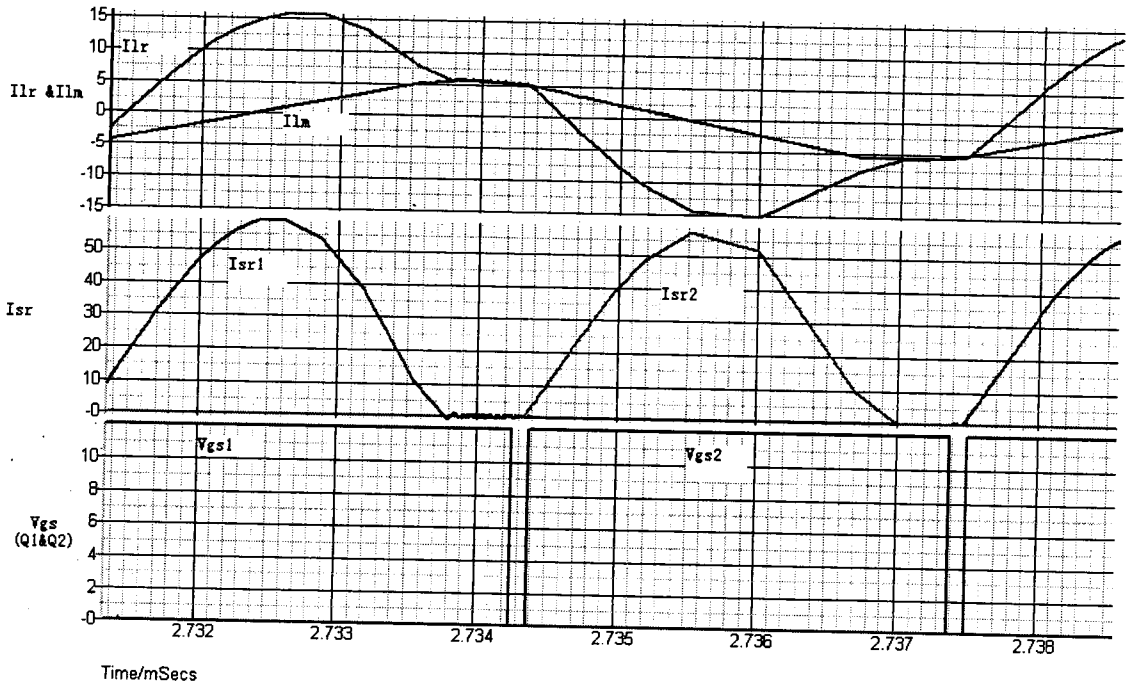

Fig. 6

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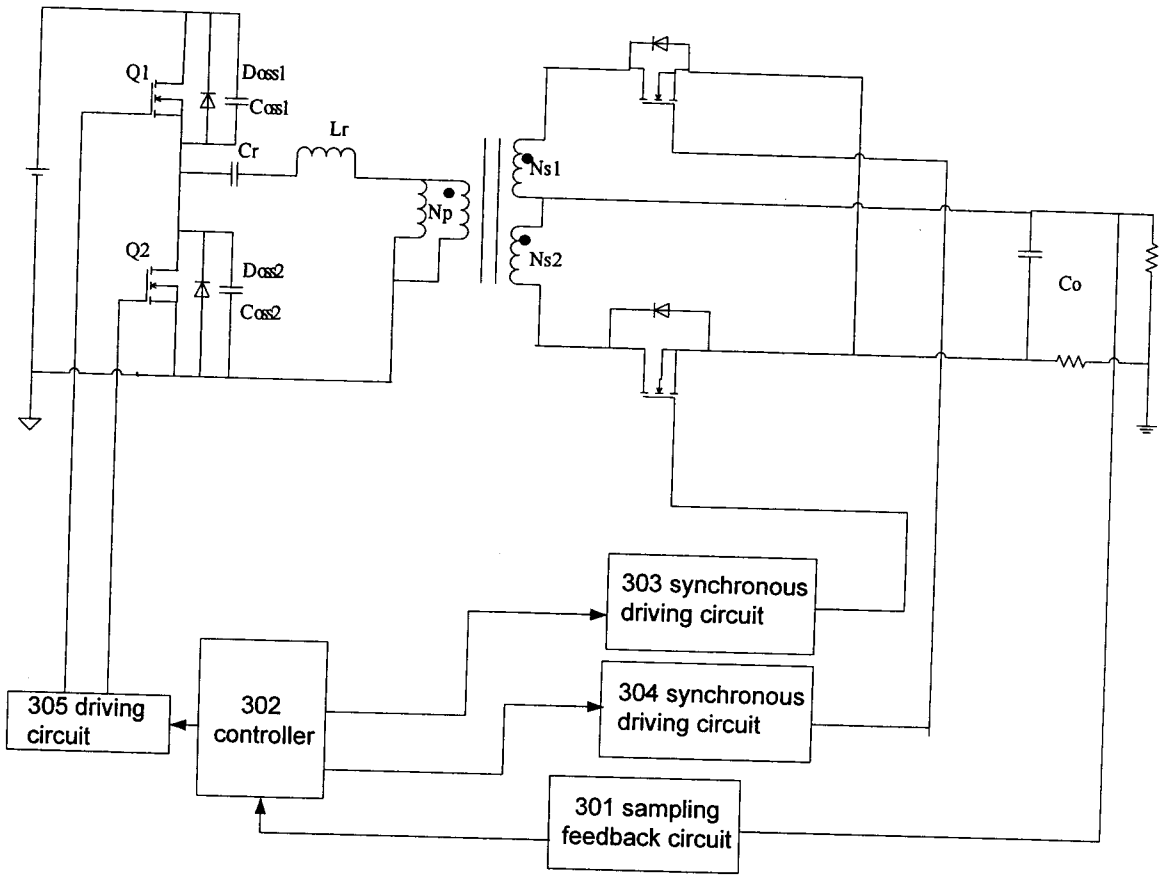

Fig. 7

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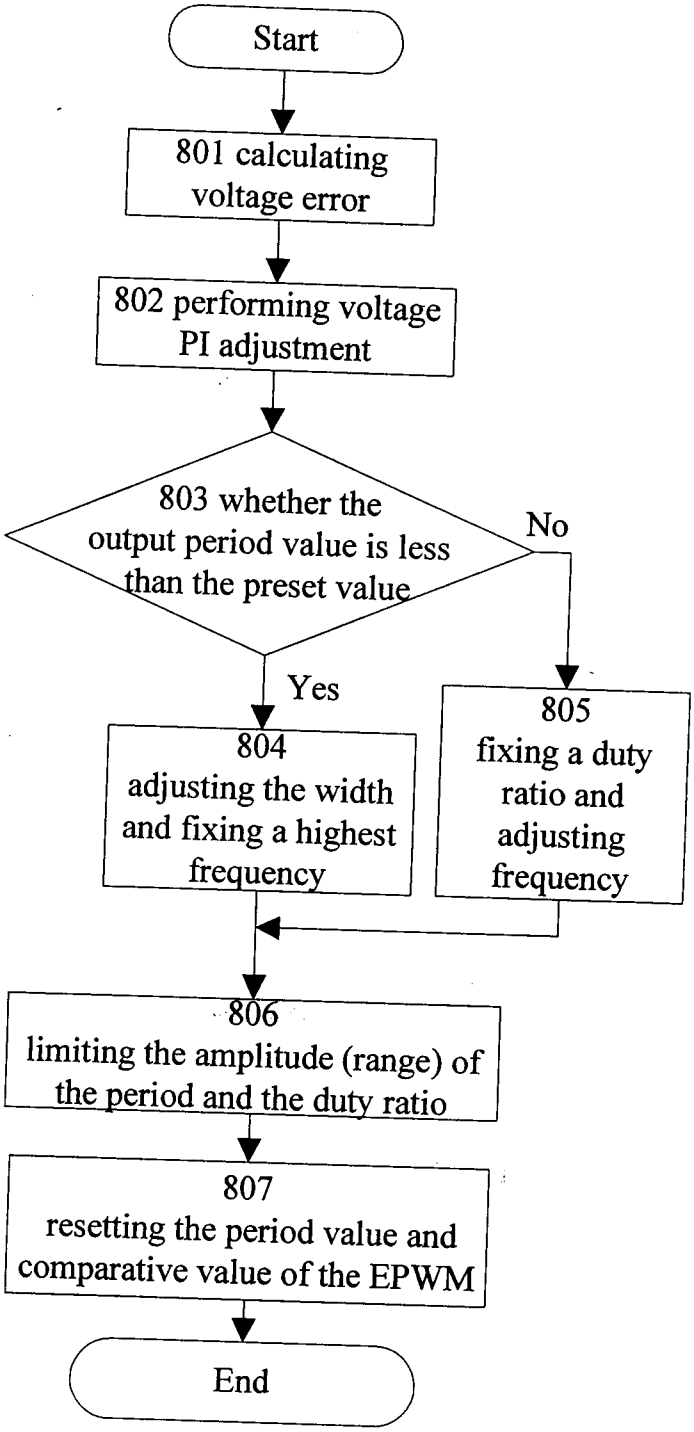

Fig. 8

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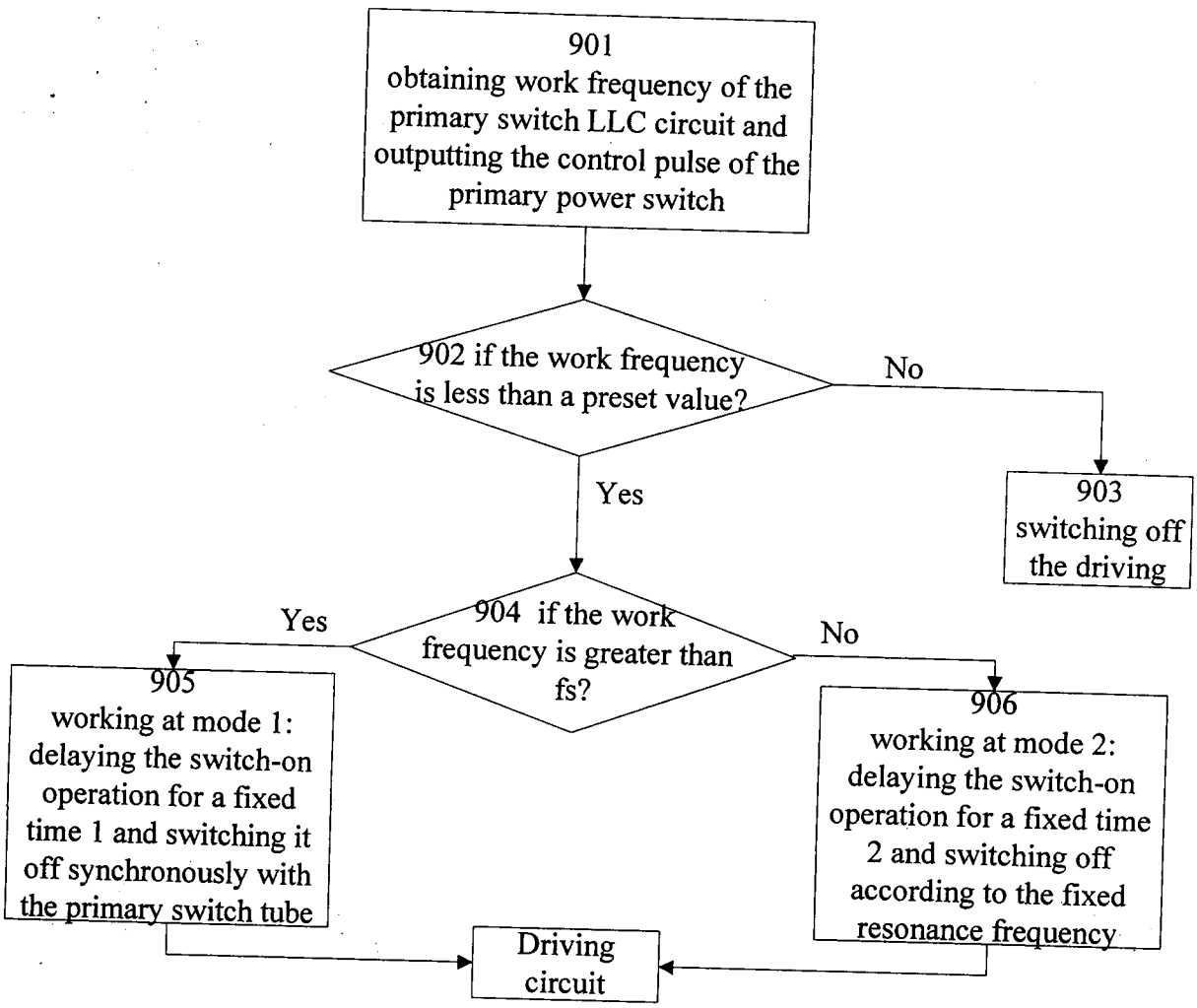

Fig. 9

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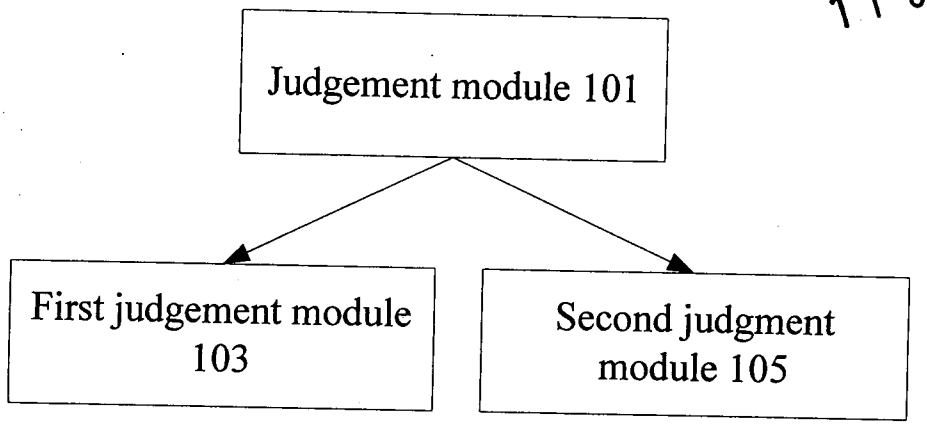

Fig. 10

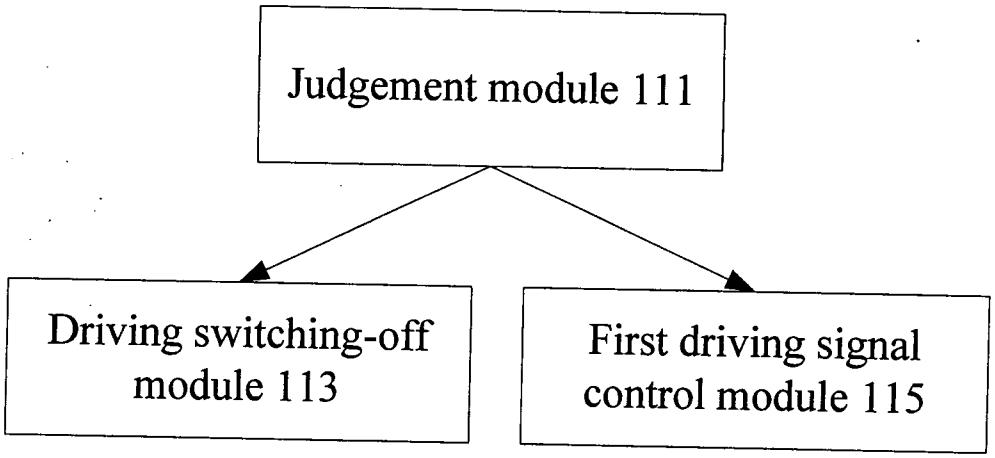

Fig. 11

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