Claims

1. A control method for an uninterruptible power supply system, comprising:

when the UPS system works in a UPS power supply mode, if a SOC of a battery≥ 0.8, constructing an optimization function $Q=J_1+J_2$;

when the UPS system works in the UPS power supply mode, if the SOC of the battery < 0.8, constructing an optimization function $Q=J_1+J_2+J_3$;

when the UPS system works in a battery power supply mode, or when the UPS system works in a battery feed mode, if the SOC of the battery > 0.2, constructing an optimization function $Q=J_2+J_4$;

wherein,

$$J_1 = |u_{r\alpha_ref}(k+1)-u_{r\alpha}(k+1)|+|u_{r\beta_ref}(k+1)-u_{r\beta}(k+1)|+\lambda_1|U_{c1}(k+1)-U_{c2}(k+1)|;$$

$$J_2 = |u_{i\alpha_ref}(k+1)-u_{i\alpha}(k+1)|+|u_{i\beta_ref}(k+1)-u_{i\beta}(k+1)|;$$

$$J_3 = |U_{dc_ref}-U_{dc}(k+1)|+|i_{L_ref}-i_L(k+1)|;$$

$$J_4 = |U_{dc_ref}-U_{dc}(k+1)|+|i_{L_ref}-i_L(k+1)|+\lambda_2|U_{c1}(k+1)-U_{c2}(k+1)|;$$

$u_{r\alpha}(k+1)$ is a projection of alternating current voltage $u_r(k+1)$ output by a T-type three-level rectifier on an α-axis at sampling time $k+1$, and $u_{r\alpha_ref}(k+1)$ is a projection of a reference value $u_{r_ref}(k+1)$ of the alternating current voltage output by the T-type three-level rectifier on the α-axis; $u_{r\beta}(k+1)$ is a projection of the alternating current voltage $u_r(k+1)$ output by the T-type three-level rectifier on a β-axis at the sampling time $k+1$, and $u_{r\beta_ref}(k+1)$ is a projection of the reference value $u_{r_ref}(k+1)$ of the alternating current voltage output by the T-type three-level rectifier on the β-axis; $U_{c1}(k+1)$ and $U_{c2}(k+1)$ represent voltage values of direct current side capacitors C_1 and C_2 of the T-type three-level rectifier at the sampling time $k+1$ respectively, $u_{i\alpha}(k+1)$ is a projection of alternating current voltage $u_i(k+1)$ output by a T-type three-level inverter on the α-axis at the sampling time $k+1$, $u_{i\alpha_ref}(k+1)$ is a projection of a reference value $u_{i_ref}(k+1)$ of the alternating current voltage output by the T-type three-level inverter on the α-axis at the sampling time $k+1$, $u_{i\beta}(k+1)$ is a projection of alternating current voltage $u_i(k+1)$ output by the T-type three-level inverter on the β-axis at the sampling time $k+1$, $u_{i\beta_ref}(k+1)$ is a

projection of the reference value $u_{i_ref}(k+1)$ of the alternating current voltage output by the T-type three-level inverter on the β-axis, λ_1 is a control weight of the T-type three-level rectifier, and λ_2 is a control weight of a three-level three-phase direct current converter; i_{L_ref} is an inductance current value of the T-type three-level three-phase direct current converter; U_{dc_ref} is an instruction value of direct current side voltage of the T-type three-level rectifier, and $U_{dc}(k+1)$ is a value of direct current side capacitor voltage at the time $k+1$; and

selecting an output quantity of each switch tube when the optimization function is minimum, wherein the output quantity 1 represents on of the switch tube, and the output quantity 0 represents off of the switch tube; and controlling on-off of the switch tube of the T-type three-level rectifier, the switch tube of the T-type three-level inverter, and the switch tube of the three-level three-phase direct current converter according to the output quantity of the corresponding switch tube;

wherein $u_{r_ref}(k+1)$ and $u_{i_ref}(k+1)$ are calculated by an electrical state quantity prediction method for an uninterruptible power supply system, the electrical state quantity prediction method comprises:

a calculation formula for a predicted value $i_g(k+1)$ of alternating current output by a T-type three-level rectifier of the UPS system is:

$$i_g(k+1)=(1-\frac{R_s T_s}{L_s})i_g(k)+\frac{T_s}{L_s}[u(k)-u_g(k)];$$

a calculation formula for a reference value $u_{r_ref}(k)$ of alternating current voltage output by the T-type three-level rectifier of the UPS system is:

$$u_{r_ref}(k)=\frac{L_s}{T_s}i_{rg_ref}(k)+(R_s-\frac{L_s}{T_s})i_g(k)+u_g(k);$$

a calculation formula for a reference value $u_{i_ref}(k)$ of alternating current voltage output by a T-type three-level inverter of the UPS system is:

$$u_{i_ref}(k)=u_n(k);$$

a calculation formula for a predicted value $u(k+1)$ of alternating current voltage of the UPS system is:

$$u(k+1)=u(k)e^{j\omega T_s};$$

a calculation formula for a predicted value $U_{cn}(k+1)$ of a voltage stabilization capacitor on a direct current side of the UPS system is:

$$U_{cn}(k+1)=U_{cn}(k)+\frac{T_s}{C_n}i_{Cn}(k);$$

a calculation formula for a predicted value $i_L(k+1)$ of inductance current of a three-level three-phase direct current converter of the UPS system is:

$$i_L(k+1)=\frac{T_s}{L}[U_{ES}-(T_1 \| T_3)U_{C1}(k)-(T_2 \| T_4)U_{C2}(k)]+i_L(k);$$

wherein $u(k)$ is alternating current voltage output by the T-type three-level rectifier/inverter, L_s is a value of filter inductance output by the T-type three-level rectifier, T_s is sampling interval time, R_S is resistance of an output line of the UPS system, $i_g(k)$ is grid side current at sampling time k, and $u_g(k)$ is grid voltage at the sampling time k; $u_{r_ref}(k)$ is instruction voltage output by an alternating current side of the T-type three-level rectifier at the sampling time k, and $i_{rg_ref}(k)$ is an instruction value of grid side current at the sampling time k; $u_n(k)$ is a sampling value of rated load voltage at the sampling time k; ω is an angular frequency of a grid; $U_{cn}(k+1)$ is a voltage value of a direct current side capacitor C_n of the T-type three-level rectifier at sampling time $k+1$, $U_{cn}(k)$ is a voltage value of C_n at the sampling time k, and $i_{cn}(k)$ is a value of current flowing through C_n at the sampling time k; U_{ES} is voltage of an energy storage battery, L is an inductance value of the three-level three-phase direct current converter of the UPS system, T_1-T_4 are output states of a switch tube of the three-level three-phase direct current converter, and $i_L(k)$ is an inductance current value of the three-level bidirectional direct current converter at the time k; n=1, 2; and || represents a logical OR operation.

2. The control method for an uninterruptible power supply system of claim 1, wherein $\lambda_1+\lambda_2=1$.

3. A control system for an uninterruptible power supply system, comprising a processor and a memory, wherein the processor is used to execute a computer program stored in the memory; and the computer program is configured to execute the steps of the control method according to claim 1 or 2.