CLAIMS

What is claimed is:

1. A method for energy recovery of an electric vehicle, comprising the following steps:

S1, obtaining a handle opening L and a rotation speed n of a motor by sampling, and determining the handle opening L;

S11, obtaining the handle opening L and the rotation speed n of the motor by sampling, and performing filter processing;

S12, determining whether the handle opening L is smaller than an energy recovery exit threshold L0 or not, and if the handle opening L is smaller than the energy recovery exit threshold L0, clearing an energy recovery enable flag F1, otherwise, executing step S13; and

S13, determining whether the handle opening L is greater than an energy recovery enable threshold L2 or not, and if the handle opening L is greater than the energy recovery enable threshold L2, setting up the energy recovery enable flag F1.

S2, calculating a current handle target torque T** by a handle-torque control algorithm according to the handle opening L;

S3, calculating a current target braking torque T by a speed-torque control algorithm according to the rotation speed n of the motor; and

S4, controlling the motor torque to change from a current value to a target value according to the current target braking torque T, to complete an energy recovery operation.

2. The method for energy recovery of an electric vehicle according to claim 1, wherein step S2 comprises the following steps:

S21, determining whether the energy recovery enable flag F1 is set up or not; if the energy recovery enable flag F1 is not set up, setting an effective interval for handle driving as the energy recovery exit threshold L0 to a maximum handle opening value L3, obtaining, by the motor, a positive torque through a current drive torque Map, and making a vehicle enter an acceleration state from a stationary state or a deceleration state; and if the energy recovery enable flag F1 is set up, setting an effective interval for handle braking as the energy recovery exit threshold L0 to a preset handle threshold L1, and setting the effective interval for handle driving as the preset handle threshold L1 to the maximum handle opening value L, and then executing step S22;

S22, determining whether the handle opening L is greater than the preset handle threshold L1; if the handle opening L is greater than the preset handle threshold L1, obtaining, by the motor, a positive torque through the current drive torque Map, and keeping the vehicle to move forward; and if the handle opening L is smaller than the preset handle threshold L1, executing step S23;

S23, calculating a current maximum handle braking torque T*, a calculation formula of which is as follows:

$$T^*(L) = \frac{(L_0 - L) \times T_{max}}{L_0};$$

wherein L0 is the energy recovery exit threshold, L is the handle

opening obtained by sampling, and Tmax is the maximum braking torque of the motor; and

S24, performing weighted summation on the current maximum handle braking torque value T* and a torque value obtained by the current drive torque Map, to obtain the current handle target torque T**.

3. The method for energy recovery of an electric vehicle according to claim 2, wherein step S3 comprises the following steps:

S31, determining whether the current handle target torque T** is greater than 0 or not; if the current handle target torque T** is greater than 0, keeping the vehicle to move forward; and if the current handle target torque T** is smaller than 0, performing energy feedback braking, and executing step S32;

S32, determining whether the rotation speed n of the motor is greater than a lower rotation speed limit n1; if the rotation speed n of the motor is smaller than the lower rotation speed limit n1, defining the current target braking torque T to be 0; and if the rotation speed n of the motor is greater than the lower rotation speed limit n1, executing step S33;

S33, determining whether the rotation speed n of the motor is greater than an upper rotation speed limit n2 or not; if the rotation speed n of the motor is greater than the upper rotation speed limit n2, defining the current target braking torque T to be equal to the current handle target torque T**; and if the rotation speed n of the motor is smaller than the upper rotation speed limit n2, executing step S34; and

S35, calculating the current target braking torque T, a calculation

formula of which is as follows:

$$T(L) = \frac{(n-n_1)\times T^{**}}{n_1-n_2};$$

wherein T is the current target braking torque, T** is the current handle target torque, n is the rotation speed of the motor obtained by sampling, n1 is the lower rotation speed limit, and n2 is the upper rotation speed limit.

4. The method for energy recovery of an electric vehicle according to claim 3, wherein:

When the motor is a permanent magnet synchronous motor, in a permanent magnet synchronous motor, a calculation formula of an electromagnetic torque is as follows:

$$T_e = \frac{3}{2}p[\varphi_f i_q + (L_d - L_q)i_d i_q];$$

wherein T_e is the motor electromagnetic torque, φ_f is a rotor flux generated by a permanent magnet, i_d and i_q are the dq-axis magnitudes of current, and L_d and L_p are a direct-axis inductance and a quadrature-axis inductance, respectively.