WHAT IS CLAIMED IS:

1. A steering system, comprising:

a steering wheel end shaft (600), a steering device end shaft (700), and an electric driving mechanism (300) configured to drive decoupling or coupling of the steering wheel end shaft (600) and the steering device end shaft (700), wherein the steering wheel end shaft (600), the steering device end shaft (700) and the electric driving mechanism (300) are coaxially disposed; and

a torque feedback mechanism configured to apply a damping torque to the steering wheel end shaft (600) in a decoupled state, to enhance an operation feeling of a steering wheel (900) that is connected with the steering wheel end shaft (600) in a transmission way,

characterized in that the torque feedback mechanism comprises:

an outer rotor motor (200), disposed coaxially with the steering wheel end shaft (600) and configured to provide a driving force; and

a planetary gear reduction mechanism (100), disposed coaxially with the steering wheel end shaft (600) and configured to transfer, to the steering wheel end shaft (600), the driving force provided by the outer rotor motor (200) to apply the damping torque to the steering wheel end shaft (600).

2. The steering system according to claim 1, wherein the torque feedback mechanism is further configured to apply a reset torque to the steering wheel end shaft (600) upon activation of a reset mode, to drive the steering wheel end shaft (600) to be reset to a steering angle before the decoupling.

3. The steering system according to claim 1 or 2, wherein the torque feedback mechanism is arranged coaxially with the steering wheel end shaft (600).

4. The steering system according to claim 3, further comprising an outer housing (301), disposed coaxially with the steering wheel end shaft (600) and the steering device end shaft (700), wherein the steering wheel end shaft (600) is axially rotatably supported in the outer housing (301);
the steering device end shaft (700) is fixed in the outer housing (301); and at least one of the torque feedback mechanism and the electric driving mechanism (300) is mounted in the outer housing (301).

5. The steering system according to claim 4, wherein a stator (201) of the outer rotor motor (200) is fixed coaxially with the steering wheel end shaft (600); and an outer rotor (203) of the outer rotor motor (200) is axially rotatably mounted to the steering wheel end shaft (600) by a rotary bearing (202).

6. The steering system according to claim 5, wherein the planetary gear reduction mechanism (100) comprises: a plurality of stages of sun gear mechanisms arranged coaxially with the steering wheel end shaft (600), wherein two adjacent stages of sun gear mechanisms are axially spaced apart from each other; a last-stage sun gear mechanism (101) is fixed coaxially with the steering wheel end shaft (600); other sun gear mechanisms are axially rotatably mounted to the steering wheel end shaft (600) by rolling bearings (111, 112); each stage of the sun gear

mechanisms in the other sun gear mechanisms is in gear meshing with planetary gears, wherein the planetary gears are capable of revolving around an axis of the stage of the sun gear mechanisms while rotating around axes thereof; a central shaft of the planetary gears meshed with an N^{th}-stage sun gear mechanism is connected with an $(N+1)^{th}$-stage sun gear mechanism; N is an integer; N is greater than or equal to 1 and less than a total number of the stages of the sun gear mechanisms; and planetary gears (107) having a central shaft connected with a first-stage sun gear mechanism (108) are in gear meshing with the outer rotor (203).

7. The steering system according to any of claims 1 to 6, wherein the electric driving mechanism (300) comprises:

a slidable sleeve, sleeved outside the steering wheel end shaft (600) and the steering device end shaft (700) and configured to translate along an axial direction of the steering wheel end shaft (600) and the steering device end shaft (700) to realize decoupling or coupling between the steering wheel end shaft (600) and the steering device end shaft (700); and

a motor, configured to provide a driving force to drive the slidable sleeve to translate along the axial direction of the steering wheel end shaft and the steering device end shaft.

8. The steering system according to claim 7, wherein the motor is a linear motor (380); a mover of the linear motor (380) is fixedly connected with the slidable sleeve (381); and an elastic element (382) is disposed on at least one axial end of the slidable sleeve (381) to reduce vibration of the slidable sleeve (381) during the translation along the axial direction.

9. The steering system according to claim 7, wherein the motor is an interior rotor motor; a rotor (303) of the interior rotor motor is a hollow structure; the hollow structure is axially rotatably mounted to outer sides of the steering wheel end shaft (600) and the steering device end shaft (700); and the slidable sleeve (800) is coaxially disposed in the hollow structure and is threadedly connected with the hollow structure.

10. The steering system according to claim 9, wherein a limiting groove (803) and splines (801) are formed on an inner circumferential surface of the slidable sleeve (800) along a direction parallel to the axis; a protrusion (605) allowed to be accommodated in the limiting groove (803) is formed on an outer circumferential surface of one of the steering wheel end shaft (600) and the steering device end shaft (700); and external splines (701) capable of being splined with the slidable sleeve (800) are formed on an outer circumferential surface of the other of the steering wheel end shaft (600) and the steering device end shaft (700).

11. The steering system according to any of claims 7 to 10, further comprising an outer housing (301), disposed coaxially with the steering wheel end shaft (600) and the steering device end shaft (700), wherein the steering wheel end shaft (600) is axially rotatably supported in the outer housing (301); the steering device end shaft (700) is fixed in the outer housing (301); and a stator of the motor is fixed in the outer housing (301).

12. The steering system according to any of claims 7 to 11, further comprising:

a status sensor, configured to detect the decoupled state or a coupled state of the steering

wheel end shaft (600) and the steering device end shaft (700); and

a controller, configured to receive a decoupling instruction or a coupling instruction and control, according to the decoupled state or the coupled state detected by the status sensor, the motor to drive the slidable sleeve to realize decoupling or coupling between the steering wheel end shaft (600) and the steering device end shaft (700).

13. The steering system according to claim 12, wherein the status sensor is capable of inspecting the decoupled state or the coupling state of the steering wheel end shaft (600) and the steering device end shaft (700) according to a set period.

14. The steering system according to claim 12 or 13, further comprising an alarm module, configured to send an alarm signal before a vehicle travels and when the status sensor detects that the steering wheel end shaft (600) and the steering device end shaft (700) are in the decoupled state.

15. The steering system according to any of claims 12 to 14, wherein the status sensor comprises a rheostat (21), a current detection element (22), and a power supply (23); the power supply (23) is connected in series with the rheostat (21) to form a circuit; the current detection element (22) is configured to detect a current in the circuit and transmit a detected current signal to the controller; and a rheostat slider of the rheostat (21) is fixed to the slidable sleeve.

16. The steering system according to claim 15, wherein the controller is further capable of

stopping controlling the motor when the slidable sleeve is moved to an extreme position.

17. A vehicle, comprising the steering system according to any of claims 1 to 16.