CLAIMS

1. A rotor system, comprising:

a rotating shaft (100), a shaft body of the rotating shaft being of an integrated structure and the rotating shaft being horizontally arranged;

a motor (200), an air compressor (300) and a turbine (400) which are arranged on the rotating shaft in sequence; and

at least two radial bearings (600, 700) and a thrust bearing (500) which are arranged on the rotating shaft (100) and are all non-contact bearings,

wherein

the at least two radial bearings (600, 700) comprise a first radial bearing (600) and a second radial bearing (700), the first radial bearing being (600) arranged on one side of the motor (200) away from the air compressor (300), and the second radial bearing (700) being arranged between the air compressor (300) and the turbine (400),

wherein

the thrust bearing (500) is arranged between the first radial bearing (600) and the motor (200); or

the thrust bearing (500) is arranged on one side of the first radial bearing (600) away from the motor (200); or

the thrust bearing (500) is arranged between the motor (200) and the air compressor (300);

characterized in that

the thrust bearing (500) is a gas-magnetic hybrid thrust bearing, and at least one of the at least two radial bearings (600, 700) is a gas-magnetic hybrid radial bearing or a hydrodynamic-hydrostatic gas hybrid radial bearing;

wherein the gas-magnetic hybrid thrust bearing is a foil-type gas-magnetic hybrid thrust bearing (5100) comprising:

a first thrust disc (5101) fixedly connected to the rotating shaft (100); and

a first stator (5102) and a second stator (5103) which are disposed on the rotating shaft (100) in a penetrating manner, and are arranged on two opposite sides of the first thrust disc (5101) respectively, wherein

each of the first stator (5102) and the second stator (5103) comprises a first magnetic bearing (5104) and a first foil bearing (5105); a plurality of first magnetic components is arranged on each first magnetic bearing (5104) in a circumferential direction; each first foil bearing (5105) is provided with a second magnetic component capable of interacting with the plurality of first magnetic components and generating magnetic forces with the plurality of first magnetic components, wherein

each first foil bearing (5105) is arranged between the corresponding first magnetic bearing (5104) and the first thrust disc (5101) and has a first gap (5106) with the first thrust disc (5101), and each first foil bearing (5105) is movable in an axial direction of the rotating shaft under the magnetic forces between the first magnetic components and the second magnetic component.

2. The rotor system according to claim 1, wherein

the at least two radial bearings further comprise a third radial bearing (800) arranged between the motor (200) and the air compressor (300).

3. The rotor system according to claim 1 or 2, wherein

the at least two radial bearings further comprise a fourth radial bearing (900) arranged on one side of the

turbine (400) away from the air compressor (300), wherein

the thrust bearing (500) is arranged between the first radial bearing (600) and the motor (200); or

the thrust bearing (500) is arranged on one side of the first radial bearing (600) away from the motor (200); or

the thrust bearing (500) is arranged between the motor (200) and the air compressor (300); or

the thrust bearing (500) is arranged between the air compressor (300) and the second radial bearing (700).

4. The rotor system according to claim 3, wherein

the fourth radial bearing (900) is a hydrodynamic-hydrostatic gas hybrid radial bearing.

5. The rotor system according to claim 1, wherein

a heat insulation layer is arranged on one side of the turbine (400) close to the second radial bearing (700).

6. The rotor system according to claim 1, wherein the motor (200) is a dynamic-pressure bearing motor, and a portion of the rotating shaft corresponding to a bearing of the motor is provided with a first dynamic pressure generating groove (201).

7. The rotor system according to claim 1, wherein the motor (200) is a starter-generator integrated motor.

8. The rotor system according to claim 1, wherein

the rotor system further comprises a locking device (120) configured to lock the rotating shaft when the rotating shaft is in a static state.

9. The rotor system according to claim 1, wherein

a portion of the rotating shaft where each bearing is mounted is coated with an anti-wear coating (101).

10. A rotor system control method applied to the rotor system according to claim 1, the method comprising the following steps:

powering on a static-pressure bearing in the radial bearing and a static-pressure bearing in the thrust bearing to enable the rotating shaft to move to a preset radial position, such that the thrust disc of the thrust bearing moves to a preset axial position (S101);

after a rotating speed of the rotating shaft is accelerated to a working speed, powering off the static-pressure bearing in the radial bearing and the static-pressure bearing in the thrust bearing (S102);

in the case that the rotor system is stopped, powering on the static-pressure bearing in the radial bearing and the static-pressure bearing in the thrust bearing (S103); and

after the rotating speed of the rotating shaft is reduced to zero, powering off the static-pressure bearing in the radial bearing and the static-pressure bearing in the thrust bearing (S104), wherein

powering on the static-pressure bearings comprises: powering on a magnetic bearing in the corresponding bearing, and/or conveying a gas to a static-pressure intake throttle hole in the bearing; and

powering off the static-pressure bearings comprises: powering off the magnetic bearing in the corresponding bearing, and/or stopping conveying the gas to the static-pressure intake throttle hole in the bearing.

11. A gas turbine generator set, comprising an intake channel (320), a combustion chamber (330), and the rotor

system according to any one of claims 1 to 9, wherein the intake channel (320) is communicated with an air inlet of the air compressor (300), an air outlet of the air compressor (300) is communicated with an air inlet of the combustion chamber (330), and an air outlet of the combustion chamber (330) is communicated with an air inlet of the turbine (400).

12. A gas turbine generator set control method applied to the gas turbine generator set according to claim 11, the method comprising the following steps:

powering on a static-pressure bearing in the radial bearing and a static-pressure bearing in the thrust bearing to enable the rotating shaft to move to a preset radial position, such that the thrust disc of the thrust bearing moves to a preset axial position (S11);

starting the gas turbine generator set, wherein air is compressed by the air compressor and enters the combustion chamber to be mixed with a fuel in the combustion chamber and combusted, and high-temperature and high-pressure gas discharged from the combustion chamber impacts a turbine wheel of the turbine to rotate the turbine wheel, such that the turbine wheel drives the motor to rotate through the rotating shaft to generate electricity (S12);

after a rotating speed of the rotating shaft is accelerated to a working speed, powering off the static-pressure bearing in the radial bearing and the static-pressure bearing in the thrust bearing (S13);

in the case of the shutdown of the gas turbine generator set, powering on the static-pressure bearing in the radial bearing and the static-pressure bearing in the thrust bearing (S14); and

after the rotating speed of the rotating shaft is reduced to zero, powering off the static-pressure bearing in the radial bearing and the static-pressure bearing in the thrust bearing (S15), wherein

powering on the static-pressure bearings comprises: powering on a magnetic bearing in the corresponding bearing, and/or conveying a gas to a static-pressure intake throttle hole in the bearing; and

powering off the static-pressure bearings comprises: powering off the magnetic bearing in the corresponding bearing, and/or stopping conveying the gas to the static-pressure intake throttle hole in the bearing.