Claims

1. A flux machine comprising:

a stator;

a plurality of rotors configured to rotate about a central axis of the plurality of rotors in a rotary direction, the plurality of rotors including a first rotor and a second rotor configured to rotate independently about the central axis in the rotary direction;

a plurality of coil assemblies coupled to the stator, each of the plurality of coil assemblies being in a plane orthogonal to the rotary direction; and

a plurality of magnet sets coupled to the plurality of rotors, each of the plurality of magnets sets including a first magnet coupled to the first rotor and a second magnet coupled to the second rotor, the first magnet of each of the plurality of magnet sets being configured to direct magnetic flux toward a corresponding one of the plurality of coil assemblies in a first direction, the second magnet of each of the plurality of magnet sets being configured to direct magnetic flux toward the corresponding one of the plurality of coil assemblies in a second direction,

wherein the first rotor includes a first axle configured to rotate about the central axis and the second rotor includes a second axle configured to rotate about the central axis such that the first magnet is configured to move relative to the second magnet when electrical current is present in one or more of the plurality of coil assemblies.

2. The flux machine of claim 1, wherein the first magnet and the second magnet of each of the plurality of magnet sets are permanent magnets, electromagnets, or a combination of permanent magnets and electromagnets.

3. The flux machine of claim 1, wherein each of the plurality of coil assemblies have side edges and the first magnet and the second magnet of each of the plurality of magnets sets are configured to conform to the side edges of the corresponding one of the plurality of coil

assemblies, and wherein gaps between the corresponding one of the plurality of coil assemblies and the first magnet and the second magnet are minimized.

4. The flux machine of claim 1, wherein both the first magnet and the second magnet direct magnetic flux orthogonal to the rotary direction.

5. The flux machine of claim 1, wherein the first direction is generally perpendicular to the second direction, and wherein the first direction is axial and the second direction is radial.

6. The flux machine of claim 1, wherein the first direction is generally parallel to and opposed to the second direction, and wherein the first direction and second direction are (i) both axial, or (ii) both radial.

7. The flux machine of claim 1, wherein each of the plurality of coil assemblies are rectangular or near rectangular.

8. The flux machine of claim 1, wherein each of the plurality of coil assemblies are oval in shape and each of the plurality of magnet sets are curvilinear in shape.

9. The flux machine of claim 1, wherein magnetic flux of each of the plurality of magnet sets is configured to be directed perpendicularly to a plane of the current flowing in a corresponding coil assembly.

10. The flux machine of claim 1, wherein the first rotor includes a third magnet and a fourth magnet.

11. The flux machine of claim 1, further comprising a third rotor, and wherein each of the plurality of magnet sets further includes a third magnet and a fourth magnet, the third magnet being coupled to the first rotor and configured to direct magnetic flux toward the corresponding one of the plurality of coil assemblies in a third direction, the third direction being generally parallel to and opposed to the first direction, the fourth magnet being coupled to the third rotor,

such that each of the plurality of coil assemblies on the stator is surrounded by the first magnet, the second magnet, the third magnet, and the fourth magnet of one of the plurality of magnet sets.

12. The flux machine of claim 11, wherein the third rotor includes a third axle, and wherein each of the first axle, the second axle, and the third axle are configured to rotate independently of each of the other axles.

13. The flux machine of claim 12, wherein one or more of the first rotor, the second rotor, or the third rotor is configured to function as a generator simultaneously as one or more of the other rotors functions as a motor.

14. The flux machine of claim 1, wherein each of the plurality of coil assemblies includes an electrical coil disposed within channels of a permeable core.

15. A flux machine comprising:

a stator;

a plurality of rotors configured to rotate about a central axis of the plurality of rotors in a rotary direction, the plurality of rotors including a first rotor and a second rotor configured to rotate independently about the central axis in the rotary direction;

a plurality of coil assemblies coupled to the stator, each of the plurality of coil assemblies being in a plane orthogonal to the rotary direction; and

a plurality of magnet sets coupled to the plurality of rotors, each of the plurality of magnet sets including a first magnet coupled to the first rotor and a second magnet coupled to the second rotor, the first magnet being adjacent to a first side of a corresponding one of the plurality of coil assemblies and being configured to direct magnetic flux toward the corresponding one of the plurality of coil assemblies in a first direction, the second magnet being adjacent to the first side of the corresponding one of the plurality of coil assemblies and being configured to direct magnet flux toward the corresponding one of the plurality of coil assemblies in the first direction,

wherein the first rotor includes a first axle configured to rotate about the central axis and the second rotor includes a second axle configured to rotate about the central axis such that the first magnet is configured to move relative to the second magnet when electrical current is present in one or more of the plurality of coil assemblies.

16. The flux machine of claim 15, wherein the first magnet and the second magnet of each of the plurality of magnet sets are permanent magnets, electromagnets, or a combination of permanent magnets and electromagnets.

17. The flux machine of claim 16, wherein each of the plurality of coil assemblies have side edges and the first magnet and the second magnet of each of the plurality of magnets sets are configured to conform to the side edges of the corresponding one of the plurality of coil assemblies, and wherein gaps between the corresponding one of the plurality of coil assemblies and the first magnet and the second magnet set is minimized.

18. The flux machine of claim 15 wherein the magnetic flux of the first magnet and the second magnet is directed axially or radially.

19. The flux machine of claim 18 wherein the rotary motion is orthogonal to the magnetic flux of the first magnet and the second magnet.

20. The flux machine of claim 15, wherein each of the plurality of coil assemblies are rectangular or near rectangular.

21. The flux machine of claim 15, wherein each of the plurality of coil assemblies are oval in shape and each of the plurality of magnet sets are curvilinear in shape.

22. The flux machine of claim 15, wherein magnetic flux of each of the plurality of magnet sets is configured to be directed perpendicularly to a plane of the current flowing in a corresponding coil assembly.

23. The flux machine of claim 15, wherein each of the plurality of coil assemblies includes an electrical coil disposed within channels of a permeable core.

24. A method comprising:

providing a flux machine, the flux machine including:

a stator;

a plurality of rotors, the plurality of rotors including a first rotor and a second rotor configured to rotate independently about a central axis of the plurality of rotors in a rotary direction;

a plurality coil assemblies coupled to the stator and;

a plurality of magnet sets coupled to the plurality of rotors, each of the plurality of magnet sets including a first magnet coupled to the first rotor and a second magnet coupled to the second rotor, the first rotor including a first axle configured to rotate about the central axis, the second rotor including a second axle configured to rotate about the central axis, the first magnet and the second magnet of each of the plurality of magnet sets being configured to direct magnet flux orthogonal to rotary direction;

electrically coupling the plurality of coil assemblies to an inlet current source to cause inlet current to flow through the plurality of coil assemblies; and

driving the first rotor externally to induce a supplementary current in the plurality of coil assemblies while the second rotor is simultaneously driven by at least the inlet current-flowing through the plurality of coil assemblies.

25. The method of operating a flux machine of claim 24, wherein the first magnet and the second magnet of each of the plurality of magnet sets are permanent magnets, electromagnets, or a combination of permanent magnets and electromagnets.

26. The method of operating a flux machine of claim 24, wherein a gap between one of the plurality of coil assemblies and the first magnet and second magnet of a corresponding one of the plurality of magnet sets is minimized.

27. The method of operating a flux machine of claim 24, wherein the first axle and the second axle are coaxial.

28. The method of operating a flux machine of claim 24 wherein the frequencies at which the first and second rotors are driven with respect to each other is selected to influence the current flow in the stator coils such that harmonic contributions are minimized.

29. The method of operating a flux machine of claim 24, wherein the first rotor is driven at a first frequency and the second rotor is driven at a second frequency, the first frequency being equal to the second frequency.

30. The method of operating a flux machine of claim 24, wherein the first magnet of each of the plurality of magnet sets is configured to direct magnet flux in an axial direction, and wherein the second magnet of each of the plurality of magnet sets is configured to direct magnet flux in a radial direction.

31. A flux machine comprising:

a stator;

a plurality of rotors configured to rotate about a central axis of the plurality of rotors in a rotary direction, the plurality of rotors including a first rotor and a second rotor configured to rotate independently about the central axis in the rotary direction;

a plurality of coil assemblies coupled to the stator, each of the plurality of coil assemblies being in a plane orthogonal to the rotary direction, each of the plurality of coil assemblies having a first axial side, a second axial side, a first radial side, and a second radial side; and

a plurality of magnet sets coupled to the plurality of rotors, each of the plurality of magnet sets including (i) a first axially aligned magnet and a first radially aligned magnet coupled to the first rotor, and (ii) a second axially aligned magnet and a second radially aligned magnet coupled to the second rotor, the first axially aligned magnet being configured to direct magnetic flux toward the first axial side of a corresponding one of the plurality of coil assemblies in a first axial direction, the first radially aligned magnet being configured to direct magnetic flux toward the first radial side of the corresponding one of the plurality of coil assemblies in a first radial direction, the second axially magnet being configured to direct magnetic flux toward the second axial side of the corresponding one of the plurality of coil assemblies in a second axial direction opposing the first axial direction, the second radially magnet being configured to direct magnetic flux toward the second radial side of the corresponding one of the plurality of coil assemblies in a second radial direction opposing the first radial direction,

wherein the first rotor includes a first axle configured to rotate about the central axis and the second rotor includes a second axle configured to rotate about the central axis such that the first axial magnet and the first radial magnet are configured to move relative to the second axial magnet and the second radial magnet when electrical current is present in one or more of the plurality of coil assemblies,

wherein magnetic flux of each of the plurality of magnet sets is directed orthogonal to the rotary direction, and

wherein pole faces of the same polarity of the first axial magnet and the second axial magnet face toward each other and toward the corresponding one of the plurality of coil assemblies and pole faces of the same polarity of the first radial magnet and the second radial magnet face toward each other and toward the corresponding one of the plurality of coil assemblies.

32. The flux machine of claim 1, wherein each of the plurality of magnets sets further includes a third magnet coupled to the first rotor and a fourth magnet coupled to the second rotor.

33. The flux machine of claim 1, further comprising a third rotor, wherein each of the plurality of magnet sets further includes a third magnet coupled to the first rotor, a fourth magnet coupled to the first rotor, and a fifth magnet coupled to the third rotor.

34. The flux machine of claim 33, wherein the third magnet is configured to direct magnet flux in a third direction, the third direction being generally perpendicular to the first direction and generally parallel to and opposed to the second direction.

35. The flux machine of claim 34, wherein the fourth magnet and the fifth magnet are each configured to direct magnetic flux in a fourth direction, the fourth direction being generally perpendicular to the second direction and the third direction and generally parallel to and opposed to the first direction.

36. The flux machine of claim 1, further comprising a third rotor and a fourth rotor, wherein each of the plurality of magnet sets further includes a third magnet coupled to the fourth rotor and a fourth magnet coupled to the fourth rotor.