CLAIMS

1. A rotor assembly for an axial flux machine, comprising:

at least one magnet;

a first support structure having a first annular surface on a first side and a second annular surface on a second side opposite the first side, wherein the at least one magnet is attached to the first annular surface such that the first support structure provides a flux return path for the at least one magnet; and

a second support structure configured to be attached to the second annular surface of the first support structure so as to allow torque to be transferred between the at least one magnet and the second support structure via the first support structure, wherein:

the second support structure is further configured (A) to be attached to a rotatable shaft of the axial flux machine, or (B) to function as an output or input flange of the axial flux machine,

the second support structure is adapted to rotate about an axis of rotation of the axial flux machine,

the at least one magnet has a first magnet surface that is orthogonal to a magnetization direction of the at least one magnet and faces away from the first annular surface of the first support structure,

the second support structure is further configured such that, when the second support structure is attached to the second annular surface of the first support structure and the rotor assembly is not influenced by any other magnetic components, the first annular surface is warped so that a distance between a first plane that intercepts a first point on the first magnet surface and to which the axis of rotation is normal and a second plane that intercepts a second point on the first magnet surface and to which the axis of rotation is normal is substantially greater than zero, and

the first support structure is further configured such that, when the second support structure is detached from the second annular surface of the first support structure, the first annular surface has a substantially flat configuration.

2. The rotor assembly of claim 1, wherein the second support structure is configured to be attached to a rotatable shaft of the axial flux machine.

3. The rotor assembly of claim 1, wherein the second support structure is configured to function as an output or input flange of the axial flux machine.

4. The rotor assembly of claim 1, wherein:

the first support structure is made of a first material; and

the second support structure is made of a second material which is different than the first material.

5. The rotor assembly of claim 1, wherein:

the at least one magnet comprises magnet segments; and

the second support structure is further configured to restrict radial movement of the magnet segments.

6. The rotor assembly of claim 5, wherein:

the second support structure further comprises a circular lip configured to engage outermost edges of the magnet segments to restrict the radial movement of the magnet segments.

7. The rotor assembly of claim 5, wherein:

the first support structure is further configured to allow the magnet segments to slide radially when the second support structure is detached from the first support structure.

8. The rotor assembly of claim 7, wherein:

the second support structure is further configured to be detachable from the first support structure to allow the magnet segments to be removed from the first support structure by sliding in a radial direction.

9. The rotor assembly of claim 1, wherein:

the at least one magnet comprises magnet segments; and

the first support structure further comprises ribs configured to restrict angular movement of the magnet segments.

10. The rotor assembly of claim 1, wherein:

the at least one magnet comprises a ring magnet.

11. An axial flux machine comprising the rotor assembly of claim 1, wherein:

the second support structure is attached to the second annular surface of the first support structure;

the rotor assembly is installed in the axial flux machine;

the axial flux machine further comprises a stator including at least a first winding adapted to carry current;

the rotor assembly is configured to rotate relative to the stator; and

the at least one magnet is arranged such that a first ray that extends away from and is normal to the first magnet surface intercepts the first winding.

12. The rotor assembly of claim 1, wherein:

the second point is at a larger radial distance from the axis of rotation than the first point; and

the first support structure, the second support structure, and the at least one magnet are further configured and arranged such that, when the second support structure is attached to the second annular surface of the first support structure and the rotor assembly is not influenced by any other magnetic components, then a second ray that extends away from the first magnet surface at the second point and is normal to the first magnet surface intercepts the first plane.

13. The rotor assembly of claim 1, wherein:

the at least one magnet has an inner edge disposed at the first point;

the at least one magnet has an outer edge that is opposite the inner edge and disposed at the second point; and

the first support structure, the second support structure and the at least one magnet are further configured and arranged such that, when the second support structure is attached to the second annular surface of the first support structure and the rotor assembly is not influenced by

any other magnetic components, then a ratio of the distance between the first plane and the second plane and a distance between the first point and the second point is greater than 0.002.

14. The rotor assembly of any of claims 1-13, wherein:

the second support structure is attached to the second annular surface of the first support structure;

the rotor assembly is installed in the axial flux machine; and

the axial flux machine includes at least one additional magnet that interacts with the at least one magnet to cause the distance between the first plane and the second plane to be substantially equal to zero.

15. A method, comprising:

attaching at least one magnet to a first support structure of a first support structure of a rotor assembly for an axial flux machine such that the first support structure provides a flux return path for the at least one magnet, the first support structure further comprising a second annular surface on a side of the first support structure opposite the first annular surface; and

attaching a second support structure to the second annular surface of the first support structure having the at least one magnet attached thereto so as to allow torque to be transferred between the at least one magnet and the second support structure via the first support structure, wherein:

the second support structure is configured (A) to be attached to a rotatable shaft of the axial flux machine, or (B) to function as an output or input flange of the axial flux machine,

the second support structure is adapted to rotate about an axis of rotation of the axial flux machine,

the at least one magnet has a first magnet surface that is orthogonal to a magnetization direction of the at least one magnet and faces away from the first annular surface of the first support structure,

before the second support structure is attached to the second annular surface of the first support structure, the first annular surface of the first support structure has a substantially flat configuration, and

after the second support structure is attached to the second annular surface of the first support structure and when the rotor assembly is not influenced by any other magnetic components, the first annular surface is warped so that a distance between a first plane that intercepts a first point on the first magnet surface and to which the axis of rotation is normal and a second plane that intercepts a second point on the first magnet surface and to which the axis of rotation is normal is substantially greater than zero,

16. The method of claim15, wherein the second support structure is configured to be attached to a rotatable shaft of the axial flux machine.

17. The method of claim 15, wherein the second support structure is configured to function as an output or input flange of the axial flux machine.

18. The method of claim 15, wherein:

the first support structure is made of a first material; and

the second support structure is made of a second material which is different than the first material.

19. The method of claim 15, wherein:

the at least one magnet comprises magnet segments, and

attaching the second support structure to the first support structure further comprises attaching the second support structure to the first support structure such that the second support structure restricts radial movement of the magnet segments.

20. The method of claim 15, wherein:

the second support structure further comprises a circular lip configured to engage outermost edges of the magnet segments to restrict the radial movement of the magnet segments.

21. The method of claim 19, further comprising:

detaching the second support structure from the first support structure to allow the magnet segments to be removed from the first support structure by sliding in a radial direction.

22. The method of claim 15, wherein:

the at least one magnet comprises magnet segments; and

the first support structure further comprises ribs configured to restrict angular movement of the magnet segments.

23. The method of claim 15, wherein:

the at least one magnet comprises a ring magnet.

24. The method of claim 15, further comprising:

after attaching the second support structure to the second annular surface of the first support structure, installing the rotor assembly in the axial flux machine such that the at least one magnet is arranged so that a first ray that extends away from and is normal to the first magnet surface intercepts a winding of a stator of the axial flux machine.

25. The method of claim 15, wherein:

the second point is at a larger radial distance from the axis of rotation than the first point; and

after the second support structure is attached to the second annular surface of the first support structure and when the rotor assembly is not influenced by any other magnetic components, a second ray that extends away from the first magnet surface at the second point and is normal to the first magnet surface intercepts the first plane.

26. The method of claim 15, wherein:

the at least one magnet has an inner edge disposed at the first point;

the at least one magnet has an outer edge that is opposite the inner edge and disposed at the second point; and

after the second support structure is attached to the second annular surface of the first support structure and when the rotor assembly is not influenced by any other magnetic components, a ratio of the distance between the first plane and the second plane and a distance between the first point and the second point is greater than 0.002.

27. The method of claim 15, wherein:

the second support structure further comprises at least one surface that is tapered in a radial direction so as cause the first support structure to warp to conform to a shape of the at least one surface when the second support structure is attached to the first support structure.

28. The method of any of claim 15-27, further comprising:

after attaching the second support structure to the second annular surface of the first support structure, installing the rotor assembly in the axial flux machine such that at least one additional magnet of the axial flux machine interacts with the at least one magnet to cause the distance between the first plane and the second plane to become substantially equal to zero.