CLAIMS

1. A method of controlling a hyper redundant manipulator, the hyper redundant manipulator including: a plurality of sections comprising a first free end section and a second end section; and a base arranged to receive the plurality of sections in a coiled configuration, the base being coupled to the second end section of the plurality of sections, the method comprising:

receiving a trajectory for movement of the plurality of sections;

determining an error in position and/or orientation relative to the trajectory for one or more sections of the plurality of sections, the error being caused at least in part by the coiled configuration; and

controlling movement of the one or more sections using the determined error to compensate for the error in position and/or orientation of the one or more sections.

2. A method as claimed in claim 1, wherein the error in position and/or orientation relative to the trajectory comprises a lateral component.

3. A method as claimed in claim 1 or 2, wherein the error in position and/or orientation relative to the trajectory comprises a vertical component.

4. A method as claimed in any of the preceding claims, wherein controlling movement of the one or more sections using the determined error comprises controlling movement of a plurality of sections to form an S-bend profile.

5. A method as claimed in any of the preceding claims, further comprising controlling the base to rotate in a first direction to coil the plurality of sections onto the base.

6. A method as claimed in any of the preceding claims, further comprising controlling the base to rotate in a second direction to uncoil the plurality of sections from the base.

7. A method as claimed in any of the preceding claims, wherein the plurality of sections has a length between the first free end section and the second end section,

the method further comprising determining a coiled profile, one or more uncoiling profiles, and one or more handover positions using the coiled configuration, the trajectory and the length of the plurality of sections.

8. A method as claimed in claim 7, further comprising controlling storage of the determined coiled profile, the one or more determined uncoiling profiles, and the one or more determined handover positions in a memory.

9. A method as claimed in claim 7 or 8, wherein determining the error in position and/or orientation includes comparing the trajectory with one of the one or more determined uncoiling profiles.

10. A method as claimed in any of claims 7 to 9, further comprising determining control of movement of a plurality of sections between the first free end section and a handover position along the trajectory using a tip following algorithm, the tip following algorithm using one of the one or more determined handover positions as a starting position for tip following.

11. A method as claimed in any of the preceding claims, wherein the hyper redundant manipulator is a continuum robot.

12. A method as claimed in any of the preceding claims, wherein the coiled configuration is a helical configuration.

13. A computer program that, when read by a computer, causes performance of the method as claimed in any of the preceding claims.

14. A non-transitory computer readable storage medium comprising computer readable instructions that, when read by a computer, cause performance of the method of any of claims 1 to 12.

15. Apparatus for controlling a hyper redundant manipulator, the hyper redundant manipulator including: a plurality of sections comprising a first free end section and a second end section; and a base arranged to receive the plurality of sections in a coiled configuration, the base being coupled to the second end section of the plurality of sections, the apparatus comprising a controller configured to:

receive a trajectory for movement of the plurality of sections;

determine an error in position and/or orientation relative to the trajectory for one or more sections of the plurality of sections, the error being caused at least in part by the coiled configuration; and

control movement of the one or more sections using the determined error to compensate for the error in position and/or orientation of the one or more sections.

16. Apparatus as claimed in claim 15, wherein the error in position and/or orientation relative to the trajectory comprises a lateral component.

17. Apparatus as claimed in claim 15 or 16, wherein the error in position and/or orientation relative to the trajectory comprises a vertical component.

18. Apparatus as claimed in any of claims 15 to 17, wherein the controller is configured to control movement of the one or more sections using the determined error by controlling movement of a plurality of sections to form an S-bend profile.

19. Apparatus as claimed in any of claims 15 to 18, wherein the controller is configured to control the base to rotate in a first direction to coil the plurality of sections onto the base.

20. Apparatus as claimed in any of claims 15 to 19, wherein the controller is configured to control the base to rotate in a second direction to uncoil the plurality of sections from the base.

21. Apparatus as claimed in any of claims 15 to 20, wherein the plurality of sections has a length between the first free end section and the second end section, and the controller is configured to determine a coiled profile, one or more uncoiling profiles, and one or more handover positions using the coiled configuration, the trajectory and the length of the plurality of sections.

22. Apparatus as claimed in claim 21, wherein the controller is configured to control storage of the determined coiled profile, the one or more determined uncoiling profiles, and the one or more determined handover positions in a memory.

23. Apparatus as claimed in claim 21 or 22, wherein the controller is configured to determine the error in position and/or orientation by comparing the trajectory with one of the one or more determined uncoiling profiles.

24. Apparatus as claimed in any of claims 21 to 23, wherein the controller is configured to determine control of movement of a plurality of sections between the first free end section and a handover position along the trajectory using a tip following algorithm, the tip following algorithm using one of the one or more determined handover positions as a starting position for tip following.

25. Apparatus as claimed in any of claims 15 to 24, wherein the hyper redundant manipulator is a continuum robot.

26. Apparatus as claimed in any of claims 15 to 25, wherein the coiled configuration is a helical configuration.