CLAIMS

1. A fluid-driven actuator comprising

a bending actuator including a first wall portion, a second wall portion cooperating with the first wall portion to define an undulating actuator profile, and an inner fluid bladder disposed between the first and second wall portions and following the undulating actuator profile, and

a restraint member arranged to cooperate with the bending actuator to produce a plurality of motions in response to fluid supplied to the inner fluid bladder; wherein the restraint member is detachably coupled to the bending actuator to form a plurality of folds to define the undulating actuator profile; and

wherein the fluid driven actuator further comprises a secondary bending actuator having an inner secondary fluid bladder.

2. A fluid-driven actuator according to claim 1, wherein each one of the plurality of folds forms a fold width which is adjustable by a user.

3. A fluid-driven actuator according to claim 1 or 2, wherein the bending actuator includes a plurality of flexion locking mechanisms, and the restraint member includes a plurality of restraint locking mechanisms arranged to be selectively attached to respective ones of the plurality of flexion locking mechanisms.

4. A fluid-driven actuator according to any of claims 1 to 3, wherein each one of the plurality of folds is spaced apart from each other.

5. A fluid-driven actuator according to any of claims 1 to 4, wherein the plurality of folds includes segments of folds spaced apart from each segment.

6. A fluid-driven actuator according to claim 5, wherein the number of folds within each segment is different.

7. A fluid-driven actuator according to claim 5, wherein the number of folds within each segment is the same.

8. A fluid-driven actuator according to claim 7, wherein the restraint member is cylindrical and each segment of folds are arranged around the restraint member.

9. A fluid-driven actuator according to any preceding claim wherein the secondary bending actuator is arranged in opposing relations with the bending actuator with each fold of the secondary bending actuator in registration with respective folds of the bending actuator.

10. A fluid-driven actuator according to claim 9, wherein the secondary bending actuator is arranged above the bending actuator with each fold of the secondary bending actuator in registration with respective folds of the bending actuator.

11. A fluid-driven actuator according to any of claims 1 to 10, wherein the inner secondary fluid bladder and the inner fluid bladder are arranged to be supplied with fluid independently.

12. A fluid-driven actuator according to any of claims 1 to 11, wherein the inner secondary fluid bladder includes at least two different segments which are arranged to be supplied with fluid independently.

13. A fluid-driven actuator according to any preceding claim, wherein the inner fluid bladder includes at least two different segments which are arranged to be supplied with fluid independently.

14. A fluid-driven actuator according to any preceding claim, further comprising a plurality of the bending actuators, pairs of the bending actuators are arranged in opposing relations at respective segments of the restraint member,

wherein the pair of the bending actuators in one segment is oriented differently from the other pair of bending actuators in another segment.

15. A fluid-driven actuator according to claim 14, wherein the plurality of bending actuators further includes a further pair of bending actuators next to each other in a further segment.

16. A fluid-driven actuator according to any preceding claim wherein the restraint member includes a strain limiting layer for causing the bending actuator to flex in response to fluid supplied to the inner fluid bladder.

17. A fluid-driven actuator according to any preceding claim, wherein the restraint member includes an integrally formed inner straightening fluid bladder, the inner straightening fluid bladder arranged to straighten the restraint member longitudinally in response to fluid supplied to the inner straightening fluid bladder.

18. A fluid-driven actuator according to any preceding claim, wherein the fluid-driven actuator is made of TPU coated fabric, one or more layers of polymer, or network of fibres.

19. A fluid-driven actuator according to any preceding claim, wherein the inner fluid bladder is integrally formed with the bending actuator.

20. A fluid-driven actuator according to any preceding claim, further comprising a bellow-type actuator; and the bending actuator is arranged on the bellow-type actuator.

21. An assistive device for rehabilitation or prosthetic applications, comprising at least one fluid-driven actuator according to any preceding claim.

22. A robotic glove comprising at least one fluid-driven actuator according to any of claims 1 to 20.

23. An exoskeleton brace for a limb, comprising at least one fluid-driven actuator according to any of claims 1 to 20.

24. A method of producing a fluid-driven actuator according to any of claims 1 to 20, comprising integrally forming the bending actuator with the inner fluid bladder.

25. A method of producing a fluid-driven actuator according to claim 24, wherein the integrally forming includes forming an elongate actuator having the inner fluid bladder by casting or molding; and folding the elongate actuator to form the bending actuator.

26. A method of producing a fluid-driven actuator according to claim 24, further comprising attaching the bending actuator to the restraint member.

27. A method of producing a fluid-driven actuator according to claim 24, further comprising 3D printing the bending actuator with the inner fluid bladder.

28. A method of producing a fluid-driven actuator according to claim 24, further comprising bonding a TPU-coated fabric to form the inner fluid bladder; and folding the inner fluid bladder to form the bending actuator.

29. A method of producing a fluid-driven actuator according to claim 28, further comprising bonding the bending actuator to the restraint member.

30. A fluid-driven actuator comprising

a bending actuator including a first wall portion, a second wall portion cooperating with the first wall portion to define an undulating actuator profile, and an inner fluid bladder disposed between the first and second wall portions and following the undulating actuator profile, and

a restraint member arranged to cooperate with the bending actuator to produce a plurality of motions in response to fluid supplied to the inner fluid

bladder; wherein the restraint member is fixedly coupled to the bending actuator to form a plurality of folds to define the undulating actuator profile; and

wherein the fluid driven actuator further comprises a secondary bending actuator having an inner secondary fluid bladder.