

Claims

1. A robotic gripper comprising:
 - a body;
 - 5 a plurality of displacement mechanisms;
 - a plurality of finger modules removably connected or connectable to the body, such that each finger module engages with a respective displacement mechanism;
 - each finger module comprising a finger actuator cooperative with the
 - 10 other finger actuators for gripping an object; and
 - each displacement mechanism is configured for moving the respective finger module to adjust its arrangement on the body, thereby configuring the robotic gripper for gripping the object.
- 15 2. The robotic gripper according to claim 1, wherein each displacement mechanism is configured for linear and/or rotational displacement of the respective finger module with respect to the body.
3. The robotic gripper according to claim 1 or 2, wherein each finger actuator
- 20 comprises:
 - a resilient element configured for stiffening the finger actuator; and
 - a cover plate and an inflatable channel arranged at a proximal section of the finger actuator, the resilient element disposed between the cover plate and inflatable channel,
 - 25 wherein upon inflation of the channel, the inflated channel presses the resilient element against the cover plate, thereby stiffening the finger actuator;
 - and
 - wherein upon actuation and bending of the finger actuator, the resilient element moves towards a distal section of the finger actuator, the inflated
 - 30 channel preventing returning of the resilient element, thereby locking the bent finger actuator.

4. The robotic gripper according to any one of claims 1 to 3, wherein each finger actuator comprises:

a number of smaller-width bellow-shaped sections at a proximal section of the finger actuator; and

5 a number of larger-width bellow-shaped sections at a distal section of the finger actuator.

5. The robotic gripper according to any one of claims 1 to 4, wherein each finger module comprises a sleeve for wearing over the finger actuator.

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6. The robotic gripper according to any one of claims 1 to 5, wherein each finger module comprises a tactile sensor.

7. The robotic gripper according to claim 6, wherein the tactile sensors are
15 configured for providing feedback to control a grip configuration of the robotic gripper for gripping the objects.

8. The robotic gripper according to claim 7, wherein the grip configuration is controlled based on intensity of fluctuations in variance and covariance trends
20 determined by the tactile sensors.

9. The robotic gripper according to any one of claims 1 to 8, wherein the robotic gripper is cooperative with a vision system for detection of the objects.

25 10. A method for configuring a robotic gripper, the method comprising:

operating the robotic gripper comprising a plurality of finger modules and a plurality of displacement mechanisms, the finger modules removably connected to a body of the robotic gripper;

30 engaging each finger module with a respective displacement mechanism;

arranging the finger modules for gripping an object, each finger module comprising a finger actuator cooperative with the other finger actuators for gripping the object; and

moving, using the respective displacement mechanisms, one or more finger modules to adjust their arrangement on the body, thereby configuring the robotic gripper for gripping the object.

5 11. The method according to claim 10, wherein moving of the finger modules comprises linear and/or rotational displacement of the respective finger module with respect to the body.

12. A computer program comprising computer executable instructions that, when
10 executed by a processor, cause the processor to control an additive manufacturing apparatus to manufacture a product comprising the robotic gripper according to any one of claims 1 to 9.

13. A method of manufacturing a product via additive manufacturing, the method
15 comprising:

obtaining an electronic file representing a geometry of the product wherein the product comprises the robotic gripper according to any one of claims 1 to 9; and

controlling an additive manufacturing apparatus to manufacture, over
20 one or more additive manufacturing steps, the product according to the geometry specified in the electronic file.

14. A method for handling objects with a robotic gripper, the method comprising:
capturing visual data of the objects arranged at a first location using an
25 imaging device, the visual data comprising colour image data and point cloud data;

detecting the objects based on the colour image data and a trained image classifier;

selecting one or more detected objects based on the point cloud data to
30 be handled by the robotic gripper;

constructing a 3D representation for each selected object;

communicating the 3D representations to the robotic gripper for determining grip configurations to handle each selected object;

computing trajectories for the robotic gripper to move between the first location and a second location;

transferring, using the robotic gripper and the respective grip configurations, the selected objects along the computed trajectories from the first location to the second location,

wherein the selection of objects and transferring of objects are processed concurrently in a multithreaded computer process.

15. The method according to claim 14, further comprising:

receiving positional and speed data of the second location; and

locating the second location based on positional and/or speed data of the second location,

wherein the trajectories are computed based on the located second location.

16. A finger actuator comprising:

a resilient element for stiffening the finger actuator; and

a cover plate and an inflatable channel arranged at a proximal section of the finger actuator, the resilient element disposed between the cover plate and inflatable channel,

wherein upon inflation of the channel, the inflated channel presses the resilient element against the cover plate, thereby stiffening the finger actuator; and

wherein upon actuation and bending of the finger actuator, the resilient element moves towards a distal section of the finger actuator, the inflated channel preventing returning of the resilient element, thereby locking the bent finger actuator.

17. The finger actuator according to claim 16, wherein each finger actuator comprises:

a number of smaller-width bellow-shaped sections at a proximal section of the finger actuator; and

a number of larger-width bellow-shaped sections at a distal section of the finger actuator.

18. A computer program comprising computer executable instructions that, when
5 executed by a processor, cause the processor to control an additive manufacturing apparatus to manufacture a product comprising the finger actuator according to claim 16 or 17.

19. A method of manufacturing a product via additive manufacturing, the method
10 comprising:

obtaining an electronic file representing a geometry of the product wherein the product comprises the finger actuator according to claim 16 or 17; and

15 controlling an additive manufacturing apparatus to manufacture, over one or more additive manufacturing steps, the product according to the geometry specified in the electronic file.

20. A method for locking a bending profile of a finger actuator, the method comprising:

20 inflating a proximal portion of a fluidic channel of the finger actuator, the proximal fluidic channel portion arranged at a proximal section of the finger actuator;

25 upon inflation of the proximal fluidic channel portion, pressing a resilient element against a cover plate arranged at the proximal section, the resilient element disposed between the cover plate and the proximal fluidic channel portion;

stiffening the finger actuator upon said pressing of the resilient element against the cover plate;

30 inflating a distal portion of the fluidic channel to actuate the finger actuator, the distal fluidic channel portion arranged at a distal section of the finger actuator;

upon actuation of the finger actuator, bending the finger actuator and moving the resilient element towards the distal section; and

preventing returning of the resilient element by the inflated proximal fluidic channel portion, thereby locking the bent finger actuator.