CLAIMS

What is claimed is:

1. A method of fabricating a porous structure based on extrusion-based additive manufacturing using at least one processor, the method comprising:

controlling a print head of an extruder to move along a print path for extruding a material along the print path on a print bed for fabricating the porous structure; and

controlling an extrusion flow rate of the extruder, while the print head is being controlled to move along the print path for extruding the material, for forming a plurality of pores of the porous structure, wherein for each pore of the plurality of pores, said controlling the extrusion flow rate comprises adjusting the extrusion flow rate with respect to a first section of the print path to form a first extruded material portion along the first section of the print path and adjusting the extrusion flow rate with respect to a second section of the print path to form a second extruded material portion along the second section of the print path, the second extruded material portion formed being adjacent to and opposing the first extruded material portion formed, such that a space is formed therebetween constituting the pore.

2. The method according to claim 1, wherein

said adjusting the extrusion flow rate with respect to the first section of the print path comprises decreasing the extrusion flow rate with respect to the first section of the print path, and

said adjusting the extrusion flow rate with respect to the second section of the print path comprises decreasing the extrusion flow rate with respect to the second section of the print path.

3. The method according to claim 2, wherein

said decreasing the extrusion flow rate with respect to the first section of the print path forms the first extruded material portion along the first section of the print path having a thickness less than an extruded material portion formed along the print path immediately prior to and/or after the first extruded material portion, and

said decreasing the extrusion flow rate with respect to the second section of the print path forms the second extruded material portion along the second section of the print path

having a thickness less than an extruded material portion formed along the print path immediately prior to and/or after the second extruded material portion.

4. The method according to claim 2 or 3, wherein

said decreasing the extrusion flow rate with respect to the first section of the print path and said decreasing the extrusion flow rate with respect to the second section of the print path are each performed based on a function having an output corresponding the extrusion flow rate.

5. The method according to claim 4, wherein

said decreasing the extrusion flow rate with respect to the first section of the print path comprises setting the extrusion flow rate with respect to a first plurality of positions along the first section of the print path based on a first plurality of outputs of the function with respect to the first plurality of positions, respectively, and

said decreasing the extrusion flow rate with respect to the second section of the print path comprises setting the extrusion flow rate with respect to a second plurality of positions along the second section of the print path based on a second plurality of outputs of the function with respect to the second plurality of positions, respectively.

6. The method according to claim 5, wherein the function is a polynomial function.

7. The method according to claim 6, further comprising controlling a profile shape of the pore formed based on a first input parameter for configuring a degree of the polynomial function.

8. The method according to claim 7, further comprising configuring the polynomial function based on a second input parameter for setting a maximum extrusion flow rate and a third input parameter for setting a minimum extrusion flow rate.

9. The method according to any one of claims 5 to 8, wherein

said controlling the extrusion flow rate of the extruder comprises controlling a feed rate of the extruder for feeding a filament of the material to the print head, and

said setting the extrusion flow rate with respect to the first plurality of positions comprises setting the feed rate with respect to the first plurality of positions along the first

section of the print path based on the first plurality of outputs of the function with respect to the first plurality of positions, respectively, and

said setting the extrusion flow rate with respect to the second plurality of positions comprises setting the feed rate with respect to the second plurality of positions along the second section of the print path based on the second plurality of outputs of the function with respect to the second plurality of positions, respectively.

10. The method according to claim 9, further comprising:

for each of the first plurality of positions along the first section of the print path, controlling a print speed of the print head with respect to the position so as to have an inverse relationship to the feed rate set with respect to the position; and

for each of the second plurality of positions along the second section of the print path, controlling the print speed of the print head with respect to the position so as to have the inverse relationship to the feed rate set with respect to the position.

11. The method according to any one of claims 1 to 10, wherein the plurality of pores are arranged to form one or more mechanical property varied portions of the porous structure, each mechanical property varied portion being configured to facilitate bending or fracturing thereat.

12. The method according to any one of claims 1 to 11, wherein the material comprises a thermoplastic material.

13. The method according to claim 12, wherein the thermoplastic material has a shape memory property.

14. The method according to any one of claims 1 to 13, wherein the print path is along a plane parallel to a surface of the print bed on which the porous structure is formed.

15. A system for fabricating a porous structure based on extrusion-based additive manufacturing, the system comprising:

at least one memory; and

at least one processor communicatively coupled to the at least one memory and configured to:

control a print head of an extruder to move along a print path for extruding a material along the print path on a print bed for fabricating the porous structure; and

control an extrusion flow rate of the extruder, while the print head is being controlled to move along the print path for extruding the material, for forming a plurality of pores of the porous structure, wherein for each pore of the plurality of pores, said control the extrusion flow rate comprises adjusting the extrusion flow rate with respect to a first section of the print path to form a first extruded material portion along the first section of the print path and adjusting the extrusion flow rate with respect to a second section of the print path to form a second extruded material portion along the second section of the print path, the second extruded material portion formed being adjacent to and opposing the first extruded material portion formed, such that a space is formed therebetween constituting the pore.

16. The system according to claim 15, wherein

said adjusting the extrusion flow rate with respect to the first section of the print path comprises decreasing the extrusion flow rate with respect to the first section of the print path, and

said adjusting the extrusion flow rate with respect to the second section of the print path comprises decreasing the extrusion flow rate with respect to the second section of the print path.

17. The system according to claim 16, wherein

said decreasing the extrusion flow rate with respect to the first section of the print path forms the first extruded material portion along the first section of the print path having a thickness less than an extruded material portion formed along the print path immediately prior to and/or after the first extruded material portion, and

said decreasing the extrusion flow rate with respect to the second section of the print path comprises forms the second extruded material portion along the second section of the print path having a thickness less than an extruded material portion formed along the print path immediately prior to and/or after the second extruded material portion.

18. The system according to claim 16 or 17, wherein

said decreasing the extrusion flow rate with respect to the first section of the print path and said decreasing the extrusion flow rate with respect to the second section of the print path are each performed based on a function having an output corresponding the extrusion flow rate.

19. The system according to claim 18, wherein

said decreasing the extrusion flow rate with respect to the first section of the print path comprises setting the extrusion flow rate with respect to a first plurality of positions along the first section of the print path based on a first plurality of outputs of the function with respect to the first plurality of positions, respectively, and

said decreasing the extrusion flow rate with respect to the second section of the print path comprises setting the extrusion flow rate with respect to a second plurality of positions along the second section of the print path based on a second plurality of outputs of the function with respect to the second plurality of positions, respectively.

20. The system according to claim 19, wherein the function is a polynomial function.

21. The system according to claim 20, wherein the at least one processor is further configured to control a profile shape of the pore formed based on a first input parameter for configure a degree of the polynomial function.

22. The system according to claim 21, wherein the at least one processor is further configured to configure the polynomial function based on a second input parameter for setting a maximum extrusion flow rate and a third input parameter for setting a minimum extrusion flow rate.

23. The system according to any one of claims 19 to 22, wherein

said control the extrusion flow rate of the extruder comprises controlling a feed rate of the extruder for feeding a filament of the material to the print head,

said setting the extrusion flow rate with respect to the first plurality of positions comprises setting the feed rate with respect to the first plurality of positions along the first section of the print path based on the first plurality of outputs of the function with respect to the first plurality of positions, respectively, and

said setting the extrusion flow rate with respect to the second plurality of positions comprises setting the feed rate with respect to the second plurality of positions along the second section of the print path based on the second plurality of outputs of the function with respect to the second plurality of positions, respectively.

24. The system according to claim 23, wherein the at least one processor is further configured to:

for each of the first plurality of positions along the first section of the print path, control a print speed of the print head with respect to the position so as to have an inverse relationship to the feed rate set with respect to the position; and

for each of the second plurality of positions along the second section of the print path, control the print speed of the print head with respect to the position so as to have the inverse relationship to the feed rate set with respect to the position.

25. The system according to any one of claims 15 to 24, wherein the plurality of pores are arranged to form one or more mechanical property varied portions of the porous structure, each mechanical property varied portion being configured to facilitate bending or fracturing thereat.

26. The system according to any one of claims 15 to 25, wherein the material comprises a thermoplastic material.

27. The system according to claim 26, wherein the thermoplastic material has a shape memory property.

28. The system according to any one of claims 15 to 27, wherein the print path is along a plane parallel to a surface of the print bed on which the porous structure is formed.

29. A porous structure fabricated according to the method of any one of claims 1 to 14, wherein

the porous structure is a substantially planar porous structure,

the plurality of pores are arranged to form one or more mechanical property varied portions of the porous structure, and

the porous structure is configured to bend at the one or more mechanical property varied portions when heated above a predetermined temperature.

30. The porous structure according to claim 29, wherein the porous structure is manually deformable when heated above the predetermined temperature and becomes rigid with a

deformed configuration according to the manual deformation when cooled below the predetermined temperature.

31. The porous structure according to claim 30, wherein the porous structure functions as an orthopedic cast manually deformable when heated above the predetermined temperature for encasing an object and becomes rigid with the deformed configuration when cooled below the predetermined temperature for restricting movement of the object.

32. A computer program product, embodied in one or more non-transitory computer-readable storage mediums, comprising instructions executable by at least one processor to perform a method of fabricating a porous structure based on extrusion-based additive manufacturing according to any one of claims 1 to 14.