Large Volume Syringe Pump Extruder for Desktop 3D Printers

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Large Volume Syringe Pump Extruder for Desktop 3D Printers

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Abstract:

Syringe pump extruders are required for a wide range of 3D printing applications, including bioprinting, embedded printing, and food printing. However, the mass of the syringe becomes a major challenge for most printing platforms, requiring compromises in speed, resolution and/or volume. To address these issues, we have designed a syringe pump large volume extruder (LVE) that is compatible with low-cost, open source 3D printers, and herein demonstrate its performance on a PrintrBot Simple Metal. Key aspects of the LVE include: (1) it is open source and compatible with open source hardware and software, making it inexpensive and widely accessible to the 3D printing community, (2) it utilizes a standard 60 mL syringe as its ink reservoir, effectively increasing print volume of the average bioprinter, (3) it is capable of retraction and high speed movements, and (4) it can print fluids using nozzle diameters as small as 100 µm, enabling the printing of complex shapes/objects when used in conjunction with the freeform reversible embedding of suspended hydrogels (FRESH) 3D printing method. Printing performance of the LVE is demonstrated by utilizing alginate as a model biomaterial ink to fabricate parametric CAD models and standard calibration objects.