3D Printing by Selective Laser Sintering

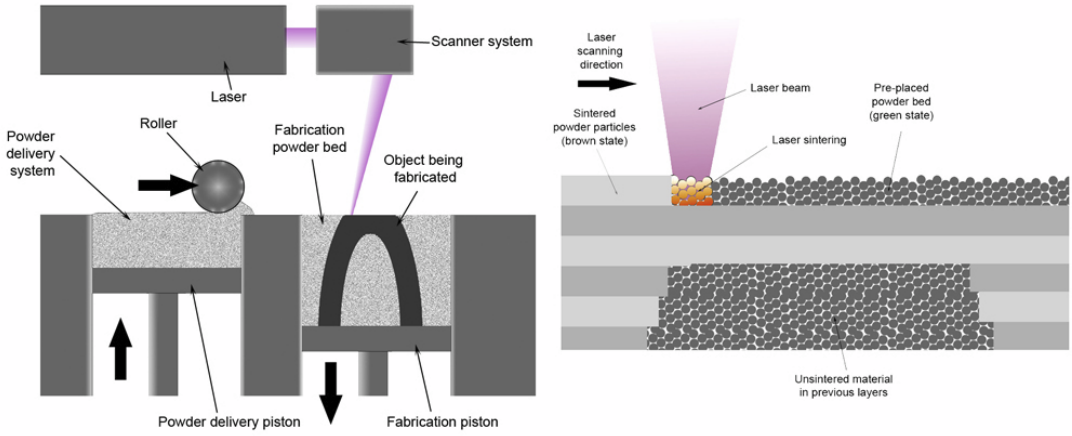

Illustration of printing process (source: wikipedia.org)

Motivation

3D printing is currently a 2.2 billion dollar industry world-wide, and is growing rapidly, almost 30% in the last two years alone. 3D printing technology is used for both prototyping and distributed manufacturing with applications in architecture, construction, industrial design, automotive, aerospace, military, engineering, civil engineering, dental/medical industries, biotech (human tissue replacement), fashion, footwear, jewellery, eyewear, education, geographic information systems, food, and many other fields.

A common technique is Selective Laser Sintering [1], where objects are produced by laying down successive layers of power (plastic, metal, ceramics, or glass) and hardening selected parts by sintering them with a laser. Then the remaining beads are removed, leaving the hardened object.

Project Description for MSc Thesis

In order to produce an acceptable result, the printing process should be reproducible, and the finished product should be of high quality (smooth surfaces, detailed shapes, and consistent hardness). We aim to optimise the sintering process using discrete particle simulations, where the sintering is modelled by a temperature-, pressure-, and time-dependent contact model [2].

In this project you will calibrate the sintering model and use the resulting model to predict the stiffness of the finished product. Calibration is done by applying simple element tests in both experiment and simulation. e.g., compression, indentation and shear tests.

We expect you to have an interest in 3D printers and their practical application and have a basic understanding of programming.

References

[1] C Deckard, *Method & apparatus for producing parts by selective sintering* (1989), US Patent 4863538

[2] S Luding, K Manetsberger, J Mullers, *A discrete model for long time sintering (2005),* Journal of Mechanics and Physics of Solids 53(2): 455-491

Supervisor

T. Weinhart, Ass. Professor of Multiscale Mechanics, Department of Thermal and Fluid Engineering