Chair for Computation in Engineering
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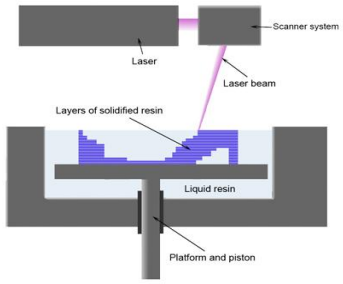
Software Lab:

Modeling: ★★★★★
Mathematics: ★★★☆☆
Programming: ★★★★★

Computational Modeling of Stereolithography

Setting

Stereolithography is an additive manufacturing process which employs a ultraviolet curable photopolymer “resin” to from a 3-D part [1] layer by layer. The resin is contained in its liquid form in a container including a platform and a piston. At the beginning of the process, the piston is close to the free surface of the resin. A laser beam traces a cross-section of the part to be produced and thereby hardens the thin layer of liquid resin. In the next step, the piston moves down by around 0.05mm to 0.15mm. Once liquid resin has accumulated on top of the solidified photopolymer, the next layer is formed by exposition to the laser. The process repeats until the part is finished.



Stereolithography process as described in [1]

One challenge in this process is the accuracy to size of the finished parts. The principle mechanism from the point of view of the resin is: (1) heating due to the laser beam (2) thereby thermal expansion (3) hardening (4) shrinkage due to hardening (5) heating due to hardening because polymerization is an exothermic process (6) cooling to dissipation of heat.

Task

Computationally model Stereolithography closely following [2] thereby

- extending the chairs new AdhoC++ code
- gaining insight into main governing effects

Supervisors

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References

[1] http://en.wikipedia.org/wiki/Stereolithography, *Wikipedia, the free encyclopedia*.

[2] Cho-Pei Jiang, You-Min Huang, Chun-Ho Liu, Dynamic finite element analysis of photopolymerization in stereolithography, *Rapid Prototyping Journal*, (12):3 p.173-180, 2006.