Mechanical testing and characterization of metallic 3D-printed specimens

Background

Metal 3D-printing (additive manufacturing) is an emerging, highly attractive technology in both research and industry sectors. This state-of-the-art manufacturing process can compete with traditional manufacturing for instance in light-weight porous structures as well as in prototyping. On the other hand, metal 3D-printing is a complex and not completely explored technology. Therefore a significant amount of research is required in order to overcome the challenges of 3D-printing and improve the properties of the printed components. Innovation Fund Denmark has made a large investment in the AM-LINE project that involves DTU, the Danish Technological Institute and several Danish companies. The main objective of DTU - in the frame of this project- is to establish a connection between the manufacturing process, the material microstructure and the mechanical properties of the printed part. The project also involves PhD students, therefore close collaboration and supervision are expected from them.

Figure 1: Porous hip implant stem

Figure 2: 3D printed titanium specimens

Scope of the work

The project will mainly focus on mechanical testing and evaluation of already designed and printed specimens. The intended experiments include tensile testing, fatigue crack growth testing, and testing of whole components like the hip implant stem shown in *Fig. 1.* Different materials such as stainless steel and titanium, as well as specimen geometries will be considered. For instance, both solid and lattice structured coupons will be investigated, cf. *Fig. 2* and *3.* Depending on the student's interests and background, the project can additional encompass material characterization of test specimens or finite element modeling of the experiments.

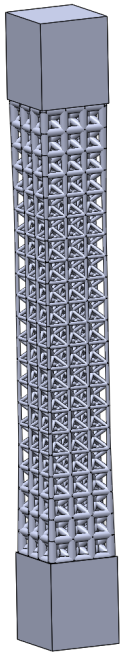

Figure 3: Lattice structure for tensile testing

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