Shape Modeling and Mechanical Analysis of Bio-degradable Scaffolds for Bone Implants

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Recent developments in the field of tissue engineering have been focused on the design and implementation of bio-degradable scaffolds for bone implants and their absorption in the bone. Various studies have analyzed the impact of the shape and strength of the scaffold on bone growth. This have been achieved by using CAD models, FE analysis and mechanical experiments. Geometric structures that composed of matrix shape filaments had been suggested and were fabricated by using additive manufacturing, then tested and their mechanical properties were investigated.

This research goal has been building a platform for analyzing and simulating the behavior of manufactured scaffold shapes under certain realistic mechanical stresses. The scaffold shape is defined as 3D parametric model using a CAD system and is additive manufacturing technology oriented. The proposed system enables to define the scaffold outer dimensions, material properties, porosity and number of filaments per layer of the scaffold. Resulting in the filament width and distance that would satisfy the requirements.

The mechanical analysis is implemented using FE analysis tools. An investigation has been applied that considers the effects of scaffold initial porosity on the process of implant degradation and bone growth. Further optimization can be applied for a pre-defined strength.

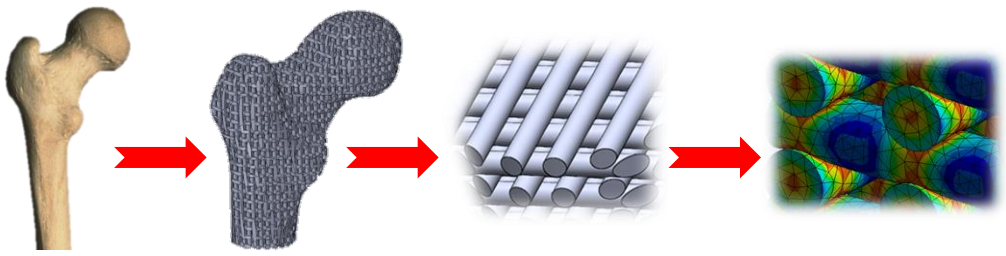

Figure 1: Finite Element Analysis

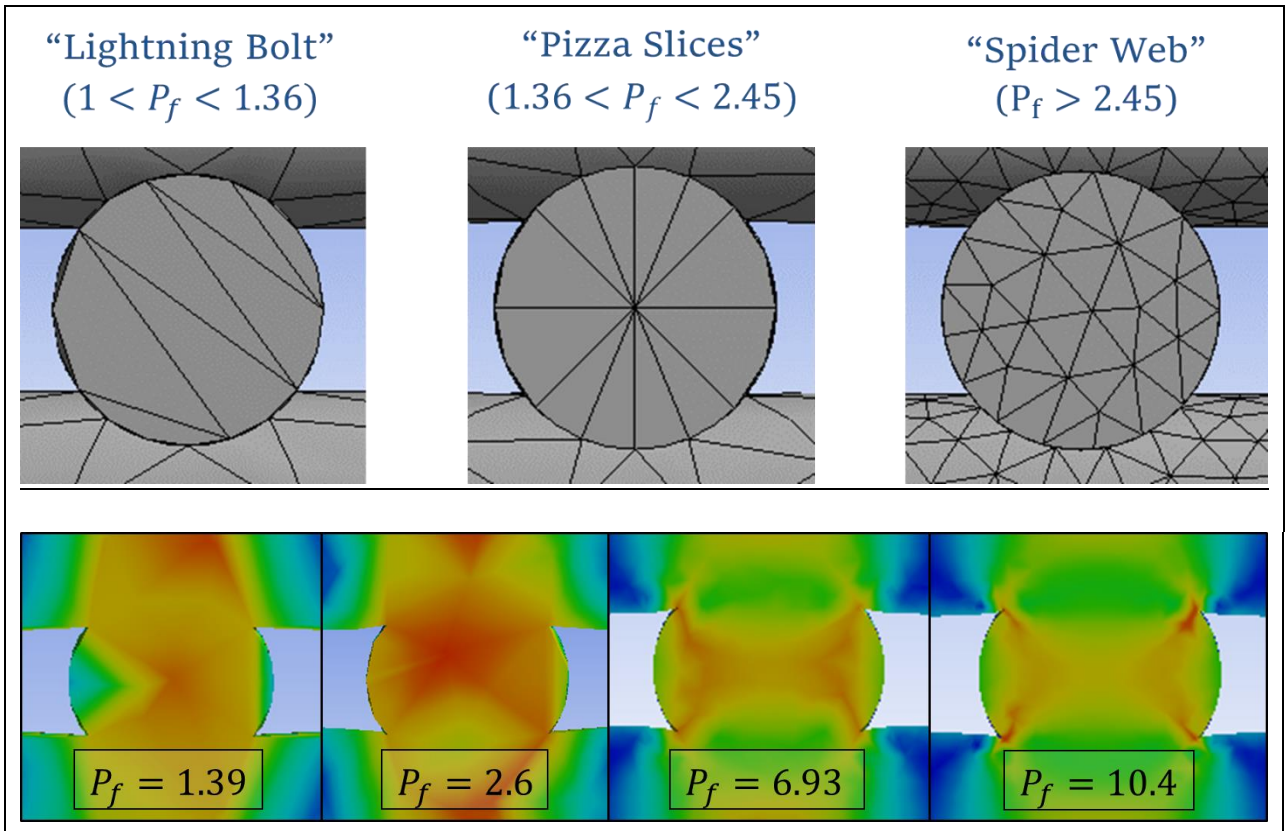

Figure 2: FEA Meshing