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OPTIMIZED MODELLING AND DESIGN SCHEMES FOR TISSUE ENGINEERING SCAFFOLDS FOR 3D PRINTING

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The use of additive manufacturing in the medical field is expanding very fast due to the ability to produce complex, low weight and personalized medical devices in a wide range of biocompatible, degradable and non-degradable materials such as polymers, metals, ceramics and composites. It also allows printing biological materials such as cells. In this field, additive manufacturing is being used to produce passive devices for repairing and restore applications and active devices for repairing, restoring and regeneration. One of the key applications of additive manufacturing in the medical field is the 3D bioprinting of tissue engineering scaffolds. The design of optimized scaffolds for tissue engineering is a key topic of research, as the complex macro- and micro-architectures required for a scaffold depends not only on the mechanical properties, but also on the physical and molecular queues of the surrounding tissue within the defect site. Thus, the prediction of optimal features for tissue engineering scaffolds is very important for its mechanical, vascular or topological properties. The relationship between high scaffold porosity and high mechanical properties is contradictory, as it becomes even more complex due to the scaffold degradation process. In this research work, optimised design schemes based on 3D modelling (CAD (computer aided design) modelling techniques and biomimetic modelling from micro-CT (computed tomography) data) and numerical simulations (such as structural, vascular and topology optimisation schemes) will be presented in order to aid the design process of optimised scaffolds for tissue engineering applications.

Biography

Henrique Almeida is an Associate Professor at School for Technology and Management (ESTG) (Mechanical Engineering Department) and Research Member of Centro de Investigação em Informática e Comunicações of Polytechnic Institute of Leiria (IPL). He has received his PhD degree in Mechanical Engineering from University of Aveiro. He is a Member of the Editorial Board of journals from Springer *(Progress in Additive Manufacturing)*, Emerald (*Rapid Prototyping Journal*), Crimson Publishers and Editorial Board Reviewer of several journals from Frontiers (*Frontiers in Mechanical Engineering*). He has more than 250 publications as journal papers, book chapters and conference proceeding papers. He also has edited 10 books and 8 national Portuguese patents.

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