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MECHANICAL PROPERTIES ASSESSMENT FOR TPMS BASED SCAFFOLDS USING HOMOGENIZATION METHODS

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Porous scaffolds for tissue engineering require a structure with characteristics to permits diffusion of oxygen, nutrients and metabolic waste necessary to a proper cellular growth. In the case of bone tissue engineering, the structural integrity of the scaffolds is also important to maintain the bone shape and function. Therefore, scaffolds must present right values for porosity, permeability and mechanical properties to satisfy these requisites [1].

The combination of computer-aided design with advanced manufacturing technics such as 3D printing permits to control the scaffold microstructure in order to obtain the desired properties [1]. Lately, geometries obtained using triply periodic minimal surfaces (TPMS) have been used to computationally design the porous scaffolds [2]. TPMS have the advantage of obtaining an interconnected structure by controlling the porosity. However, the actual permeability and stiffness of the structure is not directly controlled. Moreover, the manufacturing process has to assure that the properties assessed theoretical are verified in the obtained scaffolds.

Thus, in this work the objective is to assess the properties of TPMS obtained using Schwartz P, Schwartz D and Gyroid. These properties are computed by the asymptotic homogenization method to obtain the effective permeability and stiffness. Different porosities were tested for each surface type and an analysis was also done in order to evaluate the influence of the unit cell dimensions on the mechanical properties of the scaffolds.

Results show that the obtained properties compare well with the properties of bone scaffolds presented in literature and obtained using different means.

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