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ELASTIC BEHAVIOUR OF NANOFIBROUS MATERIALS CONSIDERING FIBER RECRUITMENT

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Abstract. In the last decades advances in materials science and tissue engineering allowed the development of new biomaterials specifically designed for the reparation or replacement of biological tissue. In this context, the ability of synthetic graft tissue to replicate the mechanical properties of the substituted biological tissue shows a positive impact on the post-surgical recovery process, diminishing the chance of rejection and, consequently, increasing the adaptability and durability of the replacement while minimizing undesired secondary effects. Concurrently, electrospinning allows the production of nanofibrous scaffolds with highly porous microstructures resembling the extracellular matrix, capable of achieving a biomimetic mechanical response and simultaneously allowing the regeneration of biological tissue. Electrospunn scaffolds can be specifically designed to work as vascular or myocardial grafts, among other biomedical applications. Therefore, understanding the relation between the microscopic properties of the nanofibers and the macroscopic mechanical response can be a significant contribution towards the design of such materials aiming to optimize its biomimetic behavior. In this work, a macroscopic constitutive model for the elastic response of nanofibrous scaffolds is derived assuming that the microscopic properties of the nanofibers are known as well as their geometric arrangement. Finally, the model is validated in comparison to experimental data from uniaxial tensile tests.