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EFFECTS OF CROSSLINK GEOMETRY ON THE ELASTIC PROPERTIES OF NANO-STRUCTURED BIOPOLYMER NETWORKS

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ABSTRACT

In cells, biopolymer networks play a major role in maintaining the cell shape and conducting the physical or chemical signals. Although it is generally recognised that these semi-flexible biopolymer networks are crucial in different cell functions, their elastic properties are not well understood [1, 2]. Due to the extreme complexity of these networks, using representative volume element (RVE) is found to be an efficient method to probe the elastic properties of these biopolymer network structures [3-5]. In this study, we mainly focus on the mechanical responses of actin filaments (F-actin) networks crosslinked by Filamin-A (FLNA). Thus a three dimensional random network model with periodic boundary conditions (PBC) [6, 7] is developed. In this model, actin filaments are modelled by straight elastic beams, however, filamins are modelled by deformable beams with different geometries. Specific geometry parameters and physical properties of both F-actin and FLNA are adopted according to existing experimental results [8, 9]. Effects of the crosslink geometry on the elasticity of the network are studied, which could give good suggestions for the design of advanced artificial biomedical equipment.

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