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MULTISCALE MECHANICS OF CYTOSKELETAL STRUCTURES

Lili Zhang[1] **and Antoine Jerusalem**[1]

[1] University of Oxford, Parks Road, Oxford, OX1 3PJ, lili.zhang@eng.ox.ac.uk; antoine.jerusalem@eng.ox.ac.uk

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In eukaryotic cells, one of the key roles of the cytoskeleton is to help cells maintain their shape and internal organization while providing the mechanical support needed for essential functions such as division, migration, and growth, among others. It consists of three major protein structures: microfilaments (or actin filaments), intermediate filaments and microtubules. In order to better understand the complex cellular active physiological processes of cells and their relation to the cytoskeletal proteins, multiscale (in time and space) techniques are required. To this end, we employ molecular dynamic simulations to model some of the major components of the cell structure. More specifically, uniaxial compression and tension as well as bending tests were performed for each of them so as to assess their mechanical responses at the atomistic level. We finally propose a homogenization scheme to bridge the atomistic responses and the macro-scale observations in the special case of the neuron.