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Modeling Deformable Fibrous Media Using Direct Numerical Simulations IRFAN KHAN, CYRUS AIDUN, Georgia Institute of Technology — A micro-mechanical approach is used in this work to investigate the behavior of deformation in saturated fibrous media. The geometry of the porous media is approximated using model geometry made of cylinders in orthogonal arrangement with appropriate boundary conditions. The approach is based on direct numerical simulation that uses a hybrid lattice Boltzmann and finite element method for modeling the fluid and solid phases respectively. It has already been shown that the macroscopic behavior of real porous media can be recovered using model geometry as long as the parameters, porosity, permeability and compressive modulus are matched. Thus based on these critical parameters it is found that cylinders in skewed orthogonal arrangement behave as real layered fibrous porous media during saturated compression. Further an analytical expression is developed to predict the compressive modulus of orthogonal arrangement of cylinders. The expression shows that there is no direct effect of fiber diameter on the compressive modulus of such arrangements, which is also confirmed through direct numerical simulations.

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