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On the Study of Lifting Mechanism of a Soft Porous Media under Fast Compression[1] QIANHONG WU, S. SANTHANAM, Villanova University, R. NATHAN, Penn State Berks, VUCBMSS TEAM — Fluid flow in a soft porous media under fast compressions is widely observed in biological systems and industrial applications. Despite of much progress, it remains unclear for the lifting mechanisms of the porous media due to the lack of complete experimental verifications of theoretical models. We report herein a unique approach to treat the limitation. The permeability of a synthetic fibrous porous media as a function of its compression was first measured. The material was then employed in a dynamic compression experiment using a porous-walled cylinder piston apparatus. The obtained transient compression of the porous media and the aforementioned permeability data were applied in different theoretical models for the pore pressure generation, which conclusively proved the validity of the consolidation theory developed by Wu et al. (JFM, 542, 281, 2005). Furthermore, the solid phase lifting force was separated from the total reaction force and was characterized by a new viscoelastic model, containing a nonlinear spring in conjunction with a linear viscoelastic Generalized Maxwell mechanical module. Excellent agreement was obtained between the experiment and the theory. Thus, the lifting forces from both the fluid and the solid were determined.

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