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How to Model the Lift Generation in a Highly Compressible Porous Media Q. WU, R. NATHAN, S. SANTHANAM, T. GACKA, CBMSS TEAM — Lift generation in highly compressible porous media under rapid compression continues to be an important topic in porous media flow for its superior potential in soft lubrication and squeeze damping. Although significant progress has been made in the study of the lift generation experimentally and theoretically (Wu et al., Journal of Fluid Mechanics 542, 281, 2005; Barabadi, et al., Journal of Heat Transfer, 131(10), 101006, 2009), how to theoretically characterize lifting forces remains unclear. In this paper the permeability of the porous media was measured using a permeater, and then dynamically compacted in a porous-walled cylinder piston apparatus. The obtained pore pressure generation was compared to two different theoretical models, a plug flow model and a consolidation model used in Wu et al. (2005) and Barabadi, et al. (2009). It shows that the consolidation model is appropriate. Furthermore, a viscoelastic model, containing a nonlinear spring in conjunction with a linear viscoelastic Generalized Maxwell mechanical module, is developed to characterize the solid phase lifting force, showing excellent agreement with experimental data. The paper presented herein, conclusively demonstrates the validity of the theoretical approach developed by Wu et al. (2005) and provides a meaningful approach in characterizing forces that contribute to lift generation in soft porous media under rapid compression.

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