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Transient Dynamics of Elastic Hele-Shaw Cell due to External Forces with Application to Impact Mitigation ARIE TULCHINSKY, AMIR GAT, Technion - Israel Institute of Technology, Faculty of Mechanical Engineering — We study the transient dynamics of a viscous liquid contained in a narrow gap between a rigid plate and an elastic plate. The elastic plate is under the influence of an externally applied time varying force acting perpendicular to its surface. We model the flow in the narrow gap via the lubrication approximation, and the plate by the Kirchhoff-Love plate theory. The viscous-elastic interaction yields a governing 6^{th}-order linear partial differential equation. We obtain a semi-similarity solution for the case of an external point force acting on the elastic plate. The pressure and deformation field during and after the application of the external force are derived and presented by closed form expressions. We examine a uniform external pressure acting on the elastic plate over a finite region and during a finite time period similar to the viscous-elastic interaction time-scale. The interaction between elasticity and viscosity is shown to reduce by order of magnitude the pressure within the Hele-Shaw cell compared with the externally applied pressure, thus suggesting such configurations may be used for impact mitigation.

Arie Tulchinsky
Technion - Israel Institute of Technology, Faculty of Mechanical Engineering

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