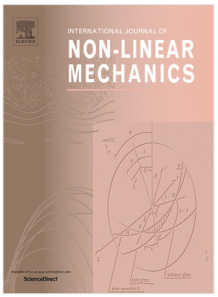
Accepted Manuscript



Effect of surface tension and geometry on cavitation in soft solids

Satish Mishra, Thomas E. Lacy, Santanu Kundu

PII: S0020-7462(17)30461-4
DOI: https://doi.org/10.1016/j.ijnonlinmec.2017.10.001
Reference: NLM 2905

To appear in: *International Journal of Non-Linear Mechanics*

Received date : 24 June 2017
Revised date : 27 September 2017
Accepted date : 3 October 2017

Please cite this article as: S. Mishra, T.E. Lacy, S. Kundu, Effect of surface tension and geometry on cavitation in soft solids, *International Journal of Non-Linear Mechanics* (2017), https://doi.org/10.1016/j.ijnonlinmec.2017.10.001

Effect of Surface Tension and Geometry on Cavitation in Soft Solids[☆]

Satish Mishra[a], Thomas E. Lacy[b], Santanu Kundu[a,*]

[a] *Dave C. Swalm School of Chemical Engineering, Mississippi State University, MS State, MS 39762*
[b] *Department of Aerospace Engineering, Mississippi State University, MS State, MS 39762.*

Abstract

Unbounded growth of cavity in soft solids subjected to internal pressure is a commonly observed phenomenon. Such phenomenon has been harnessed by developing cavitation rheology technique (CR) to investigate the local mechanical properties of many complex soft materials. The elasticity of the material, surface energy, and geometric factors in combination can dictate the cavitation behavior in a complex manner. We report a finite element based framework capturing the coupled effect of elastic strain energy and surface tension on the cavitation phenomenon. We show results for a spherical cavity in an infinite elastic media and for the CR geometry. The surface tension is shown to increase the critical pressure for cavitation. The energy release rate also depends on the surface tension. In CR geometry, by varying the distance between the needle and the immovable sample boundaries, we have captured the conditions leading to confinement. Our results provide new understanding regarding the effects of geometry and surface tension on the cavitation phenomenon in soft solids.

Keywords: `cavitation, surface tension, UEL, confinement, energy release rate`

[☆]Electronic Supplementary Information (ESI) available

[*]Corresponding author
Email address: `santanukundu@che.msstate.edu` (Santanu Kundu)