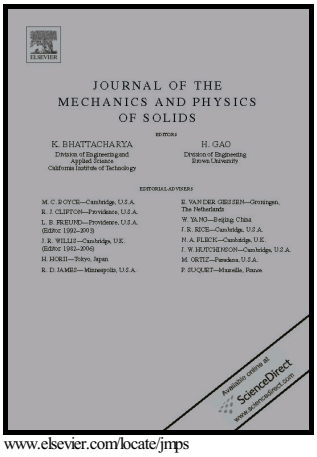

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Spherical Indentation of a Freestanding Circular Membrane Revisited: Analytical Solutions and Experiments

Congrui Jin[a,*], Ali Davoodabadi[a], Jianlin Li[b], Yanli Wang[c], Timothy Singler[a]

[a] *Department of Mechanical Engineering, State University of New York at Binghamton, Vestal, NY 13850, USA*
[b] *Energy and Transportation Science Division, Oak Ridge National Laboratory, Oak Ridge, TN 37831, USA*
[c] *Materials Science and Technology Division, Oak Ridge National Laboratory, Oak Ridge, TN 37831, USA*

Abstract

Due to the development of novel micro-fabrication techniques to produce ultra-thin materials and increasing interest in thin biological membranes, in recent years, the mechanical characterization of thin films has received a significant amount of attention. To provide a more accurate solution to predict the relationship among contact radius, load and deflection, the fundamental and widely applicable problem of spherical indentation of a freestanding circular membrane has been revisited. The work presented here significantly extends the previous contributions by providing an exact analytical solution to the governing equations of Föppl–Hecky membrane indented by a frictionless spherical indenter. In this study, experiments of spherical indentation has been performed, and the exact analytical solution presented in this paper is compared against experimental data from existing literature as well as our own experimental results.

Keywords: Membrane, Thin Film, Spherical Indentation, Analytical Solution, Experiments

*Corresponding Author
Email address: cjin@binghamton.edu (Congrui Jin)