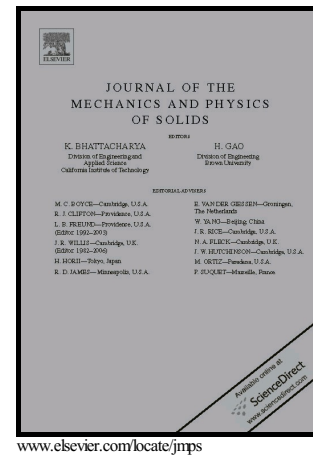


Spherical indentation of a freestanding circular membrane revisited: analytical solutions and experiments

Congrui Jin, Ali Davoodabadi, Jianlin Li, Yanli Wang, Timothy Singler



PII: S0022-5096(16)30582-8
DOI: <http://dx.doi.org/10.1016/j.jmps.2017.01.005>
Reference: MPS3040

To appear in: *Journal of the Mechanics and Physics of Solids*

Received date: 22 August 2016
Revised date: 8 January 2017
Accepted date: 10 January 2017

Cite this article as: Congrui Jin, Ali Davoodabadi, Jianlin Li, Yanli Wang and Timothy Singler, Spherical indentation of a freestanding circular membrane revisited: analytical solutions and experiments, *Journal of the Mechanics and Physics of Solids*, <http://dx.doi.org/10.1016/j.jmps.2017.01.005>

This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting galley proof before it is published in its final citable form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

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)

Download English Version:

<https://daneshyari.com/en/article/5018243>

Download Persian Version:

<https://daneshyari.com/article/5018243>

[Daneshyari.com](https://daneshyari.com)