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PII: S0022-5096(17)31022-0
DOI: 10.1016/j.jmps.2018.01.002
Reference: MPS 3260

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

Received date: 12 November 2017
Revised date: 24 December 2017
Accepted date: 6 January 2018

Please cite this article as: Junjie Liu , Zhe Chen , Xueya Liang , Xiaoqiang Huang , Guoyong Mao , Wei Hong , Honghui Yu , Shaoxing Qu , Puncture mechanics of soft elastomeric membrane with large deformation by rigid cylindrical indenter, *Journal of the Mechanics and Physics of Solids* (2018), doi: 10.1016/j.jmps.2018.01.002

Puncture mechanics of soft elastomeric membrane with large deformation by rigid cylindrical indenter

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Abstract

Soft elastomeric membrane structures are widely used and commonly found in engineering and biological applications. Puncture is one of the primary failure modes of soft elastomeric membrane at large deformation when indented by rigid objects. In order to investigate the puncture failure mechanism of soft elastomeric membrane with large deformation, we study the deformation and puncture failure of silicone rubber membrane that results from the continuous axisymmetric indentation by cylindrical steel indenters experimentally and analytically. In the experiment, effects of indenter size and the friction between the indenter and the membrane on the deformation and puncture failure of the membrane are investigated. In the analytical