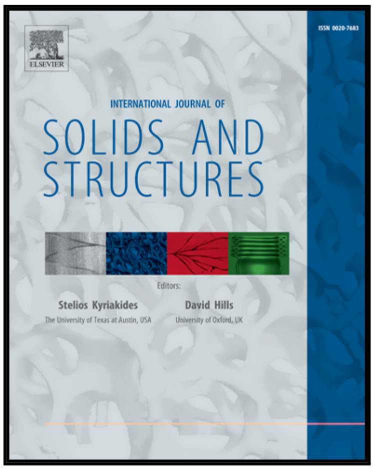
Accepted Manuscript



Analytical and numerical analysis of swelling-induced large bending of thermally-activated hydrogel bilayers

Jalal Abdolahi , Mostafa Baghani , Nasser Arbabi , Hashem Mazaheri

PII: S0020-7683(16)30234-7
DOI: 10.1016/j.ijsolstr.2016.08.017
Reference: SAS 9277

To appear in: *International Journal of Solids and Structures*

Received date: 11 May 2016
Revised date: 25 July 2016
Accepted date: 22 August 2016

Please cite this article as: Jalal Abdolahi , Mostafa Baghani , Nasser Arbabi , Hashem Mazaheri , Analytical and numerical analysis of swelling-induced large bending of thermally-activated hydrogel bilayers, *International Journal of Solids and Structures* (2016), doi: 10.1016/j.ijsolstr.2016.08.017

Analytical and numerical analysis of swelling-induced large bending of thermally-activated hydrogel bilayers

Jalal Abdolahi[a], Mostafa Baghani*[a], Nasser Arbabi[a] and Hashem Mazaheri[b]

[a]School of Mechanical Engineering, College of Engineering, University of Tehran, Tehran, Iran.

[b]Department of Mechanical Engineering, Bu-ali Sina University, Hamedan, Iran.

*Corresponding Author Email: baghani@ut.ac.ir

Abstract

Temperature-sensitive hydrogels have recently been implemented vastly for biomedical and microfluidic sensors and actuators. The accurate and efficient design of the bilayer sensors and actuators made of temperature sensitive hydrogels are of crucial importance. In this work, we develop an analytical method to solve the swelling induced bending of temperature responsive hydrogel bilayer under plane strain condition. The bilayer consists of a neutral incompressible elastomer layer attached to a temperature sensitive hydrogel layer. An analytical approach is developed to predict the thermomechanical response of these bilayers. At the other hand, the finite bending of the bilayer is simulated applying the finite element method. Several cases are solved to demonstrate the validity and performance of the proposed analytical method. The deformation and the stresses inside the layers are presented for various material parameters employing both the developed analytical formulation as well as the finite element method. A good correspondence between the presented method and the finite element method is observed. Finally, the effect of material and geometrical parameters on curvature are also investigated.