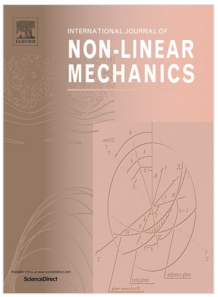
Accepted Manuscript



Simulation of inextensible elasto-plastic beams based on an implicit rate type model

Zhujiang Wang, Arun R. Srinivasa, K.R. Rajagopal, J.N. Reddy

PII: S0020-7462(17)30528-0
DOI: https://doi.org/10.1016/j.ijnonlinmec.2017.11.011
Reference: NLM 2940

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

Received date : 25 July 2017
Revised date : 22 November 2017
Accepted date : 23 November 2017

Please cite this article as: Z. Wang, A.R. Srinivasa, K.R. Rajagopal, J.N. Reddy, Simulation of inextensible elasto-plastic beams based on an implicit rate type model, *International Journal of Non-Linear Mechanics* (2017), https://doi.org/10.1016/j.ijnonlinmec.2017.11.011

Simulation of inextensible elasto-plastic beams based on an implicit rate type model

Zhujiang Wang[a], Arun R. Srinivasa[a,*], K.R. Rajagopal[a], J.N. Reddy[a]

[a]*Department of Mechanical Engineering, Texas A&M University, College Station, TX 77843-3123, United States*

Abstract

The aim of this paper is to show that it is possible to model the elasto-plastic behavior of an inextensible beam undergoing finite bending by using a novel implicit rate type response relation directly between the bending moment, curvature, and their rates. This is in contrast to conventional approaches that require the integration of elasto-plastic stress-strain relations across the thickness of the beam at each time step. The model proposed here (a) is rate independent and exhibits hysteresis, (b) requires no notion of plastic strain and no integration across the thickness, and (c) does not have a sharp yield point and instead transits smoothly between nominally elastic and inelastic response. The governing equations are solved numerically as a set of first order differential equations with very low order interpolation functions for quasi-static response and are capable of modeling both hardening and softening behavior as well as the formation of plastic hinges, etc. Since there is no yield function, there is no necessity to

*Corresponding author

Email address: arun-r-srinivasa@tamu.edu, arun.r.srinivasa@gmail.com (J.N. Reddy)