www.elsevier.com/locate/jbiomech

Simulation of balloon angioplasty in residually stressed blood vessels – application of a gradient-enhanced fibre damage model

César Polindara, Tobias Waffenschmidt, Andreas Menzel

PII: S0021-9290(16)30111-7
DOI: http://dx.doi.org/10.1016/j.jbiomech.2016.01.037
Reference: BM7563

To appear in: *Journal of Biomechanics*

Received date: 19 January 2016
Accepted date: 28 January 2016

Cite this article as: César Polindara, Tobias Waffenschmidt and Andreas Menzel, Simulation of balloon angioplasty in residually stressed blood vessels - application of a gradient-enhanced fibre damage model, *Journal o Biomechanics,* http://dx.doi.org/10.1016/j.jbiomech.2016.01.037

Simulation of balloon angioplasty in residually stressed blood vessels – application of a gradient-enhanced fibre damage model

César Polindara[a,*], Tobias Waffenschmidt[a,c], Andreas Menzel[a,b]

[a] *Institute of Mechanics, Department of Mechanical Engineering, TU Dortmund, Leonhard-Euler-Str. 5, D-44227 Dortmund, Germany*
[b] *Division of Solid Mechanics, Lund University, P.O. Box 118, SE-22100 Lund, Sweden*
[c] *3M Deutschland GmbH, Carl-Schurz-Str. 1, D-41453 Neuss, Germany*

Abstract

In this contribution we study the balloon angioplasty in a residually stressed artery by means of a non-local gradient-enhanced fibre damage model. The balloon angioplasty is a common surgical intervention used to extend or re-open narrowed blood vessels in order to restore the continuous blood flow in, for instance, atherosclerotic arteries. Inelastic, i.e. predominantly damage-related and elastoplastic processes are induced in the artery during its inflation resulting in an irreversible deformation. As a beneficial consequence, provided that the inelastic deformations do not exceed a specific limit, higher deformations can be obtained within the same pressure level and a continuous blood flow can be guaranteed. In order to study the mechanical response of the artery in this scenario, we make use of the non-local grandient-enhanced model proposed in Waffenschmidt et al. (2014). In this contribution, we extend this model to make use of an incompressible format in connection with

*Corresponding author. Tel.: +49 231 755-7902; fax: +49 231 755-2688.
Email address: cesar.polindara@udo.edu (César Polindara)