

ME338A - Final project - Paper review

“Constitutive Models of Rubber Elasticity: A Review”

Mary C. Boyce & Ellen M. Arruda

Rubber Chemistry and Technology 73: 504-523, 2000

- 1** Read the publication and try to understand what it is all about. You do not necessarily need to understand all equations.
- 2** Summarize the manuscript in less than 200 words.
- 3** Boyce & Arruda distinguish three different approaches towards rubber elasticity. Which ones? What are their fundamental differences?
- 4** Equations (19), (20) and (23) illustrate the invariant-based free energy function for the Neo-Hookean model, the Mooney-Rivlin model and the Yeoh. Derive the second Piola Kirchhoff stress for each model.
- 5** By applying the appropriate push-forward operations, derive the corresponding Cauchy stresses.
- 6** Rubber materials are incompressible. How is incompressibility handled in the constitutive formulations?
- 7** Review the publication with the help of the attached spreadsheet.

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“Biomechanics of Soft Tissues”

Gerhard A. Holzapfel

in Handbook of Material Behavior

edited by Jean Lemaitre, Academic Press, 2000

- 1** Read the publication and try to understand what it is all about. You do not necessarily need to understand all equations.
- 2** Summarize the manuscript in less than 200 words.
- 3** Why does Holzapfel introduce a fourth and sixth invariant? What are their mathematical definition and their physical interpretation?
- 4** Equations (2), (4) and (5) illustrate the free energy function for soft tissues. Derive the second Piola Kirchhoff stress for the Holzapfel model.
- 5** By applying the appropriate push-forward operations, derive the corresponding Cauchy stress and compare it with equation (6).
- 6** Most soft biological tissues are incompressible and anisotropic. How is incompressibility and anisotropy handled in the constitutive formulation?
- 7** Review the publication with the help of the attached spreadsheet.

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“Finite Deformation Analysis of Geomaterials”

Boris Jeremic, Kenneth Runesson & Stein Sture

Int. J. Numer. Anal. Meth. Geomech. 25: 809-840, 2001

- 1** Read the publication and try to understand what it is all about. You do not necessarily need to understand all equations, especially not those on pages 820-827.
- 2** Summarize the manuscript in less than 200 words.
- 3** Write equations (27), (28), (29), (30), and (32) in compact tensor notation.
- 4** Equations (47) introduces the concept of finite plasticity. Write equation (47) in compact tensor notation. What is the physical interpretation of F^P ? Which strains, elastic, plastic or total, enter the free energy formulation and are thus responsible for stresses?
- 5** Explain the two experiments that are compared in the numerical simulation section. What is the influence of the latex membrane?
- 6** Most geomaterials display plastic deformations when loaded above a certain load level. How is plasticity handled in the constitutive formulation?
- 7** Review the publication with the help of the attached spreadsheet.

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**“Stress-dependent Finite Growth in Soft Elastic Tissues”
Edward K. Rodriguez, Anne Hoger & Andrew D. McCulloch
J. Biomechanics 27: 455-47, 1994**

- 1** Read the publication and try to understand what it is all about. You do not necessarily need to understand all equations.
- 2** Summarize the manuscript in less than 200 words.
- 3** Determine the right Cauchy Green tensor and the Green Lagrange strain tensor for the elastic part of the deformation gradient given in (17) and compare your results with equation (19).
- 4** Equation (9) introduces the concept of finite growth. Write equation (9) in index notation. What is the physical interpretation of F^g ? Which strains, elastic, growth or total, enter the free energy formulation and are thus responsible for stresses?
- 5** Explain why growth can cause residual stress.
- 6** Most living biological tissues are incompressible. Moreover, they display growth when loaded above a certain load level, i.e., they adapt to their environment. How are incompressibility and growth handled in the constitutive formulation?
- 7** Review the publication with the help of the attached spreadsheet.

Instructions

Please rate this manuscript on a scale of 1-5, with 1 indicating greatest degree or best, and 5 indicating least degree or poor. You must also provide comments to the authors in prose. It is not acceptable to merely fill out numbers, and return the review.

Manuscript title _____

Authors _____

Summary (required brief summary of the context)

Presentation	(best)	1	2	3	4	5	(poor)
is clearly written		<input type="checkbox"/>					
title is appropriate		<input type="checkbox"/>					
abstract is appropriate		<input type="checkbox"/>					
figures and tables are adequate		<input type="checkbox"/>					
problem statement is clear		<input type="checkbox"/>					
provides appropriate detail		<input type="checkbox"/>					
describes limitations		<input type="checkbox"/>					
references are adequate		<input type="checkbox"/>					

Comments (required in addition to the number ratings above)

Significance	(best)	1	2	3	4	5	(poor)
represents important advance		<input type="checkbox"/>					
addresses important and realistic problem		<input type="checkbox"/>					
is likely to scale up to realistic problems		<input type="checkbox"/>					
provides new evidence for existing technique		<input type="checkbox"/>					

Comments

(required in addition to the number ratings above)

Originality

(best) 1 2 3 4 5 (poor)

- novel approach or combination of approaches
- has not been published before
- points out differences from related research
- reformulates a problem in an important way

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Comments

(required in addition to the number ratings above)

Technical content

(best) 1 2 3 4 5 (poor)

- evaluates effectiveness of techniques
- is supported with sound arguments
- is supported with theoretical analysis
- is supported with experimental results
- is technically sound

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Additional comments to the authors

Overall recommendation

accept marginal reject

Your confidence in recommendation

strong medium weak

Confidential comments to the editor

Confidential reviewer name
