Finite Deformation Continuum Mechanics

Search Continuum Mechanics Website

Search

with emphasis on metals & incompressible materials

Description

This website presents the principles of finite deformation continuum mechanics with many example applications to metals and incompressible viscoelastic materials (rubber). Examples also cover both rectangular and cylindrical coordinates.

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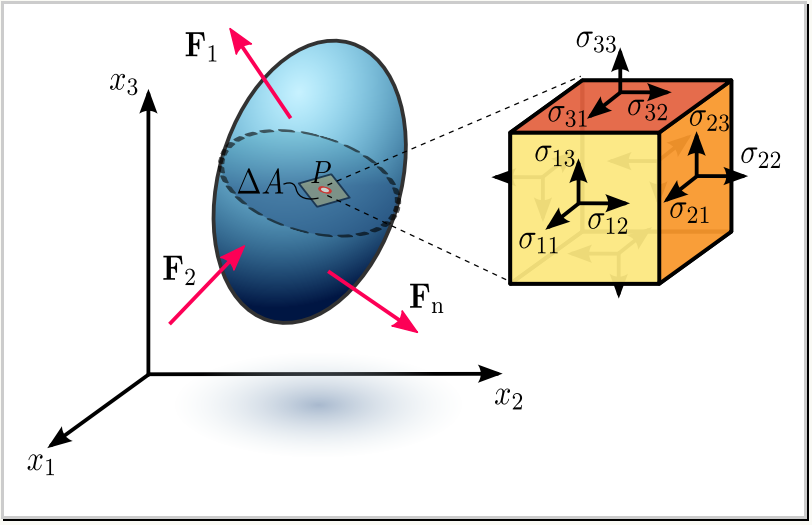

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- B. Strain
- C. Principal Stresses & Strains
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IV. DEFORMATIONS AND STRAIN
- A. Deformation Gradients

Homework

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Homework Solutions

Homework #1 Solutions
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B. Polar Decompositions
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D. Finite Element Mapping
E. Small Scale Strains
F. Green & Almansi Strains

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Spring Break: April 14-18, 2014

We'll take the week of April 14-18 off for Spring Break. No classes on the 14th and 16th.
We start back on Monday, April 21.

Kick-Off Survey

Here is the MS-Word file. And here is the text.

Schedule

Feb 3, 2014 - June 4, 2014
Mondays and Wednesdays
10:00am - 11:30am EDT

G. Principal Strains & Invariants
H. Hydrostatic & Deviatoric Strains
I. Velocity Gradients
J. True Strain
K. Material Derivatives
L. Special Strain Topics

V. STRESS

A. Stress Introduction
B. Traction Vectors
C. Energetic Conjugates
D. Stress Transformations
E. Principal Stresses & Invariants
F. Hydrostatic & Deviatoric Stresses
G. Von Mises Stress
H. Corotational Derivatives
I. Equilibrium

VI. MATERIAL BEHAVIOR

A. Continuity Equation
B. Navier Stokes Equation
C. Thermodynamics
D. Hooke's Law
E. Metal Plasticity
F. Mooney-Rivlin Models
G. Dynamic Material Properties
H. Materials and Tire Behavior

VII. MISCELLANEOUS TOPICS

A. Fasteners
B. Strain Gauges
C. Beam Bending
D. Column Buckling
E. Eccentric Column Buckling

Textbook

Introduction to the Mechanics of a Continuous Medium, Lawrence E. Malvern, 1969.

Also available electronically here (24MB):
http://www.scribd.com/doc/5987971/MALVERN-LE-Introduction-to-the-Mechanics-of-a-Continuous-Medium

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Miscellaneous Links

- http://en.wikiversity.org/wiki/Category:Continuum_mechanics
- http://www.thefullwiki.org/Continuum_mechanics
- http://en.wikipedia.org/wiki/Continuum_mechanics
- http://en.wikipedia.org/wiki/Finite_strain_theory
- Do Not Disturb Pages (the fun stuff!)

A Note About The Web Technologies Used Here

Two relatively new web technologies are used on these pages. The first is Scalable Vector Graphics, or SVG. Pages on this site will display SVG files in compatible browsers, and PNG files in incompatible ones. The advantage of SVG over PNG is that SVG graphics can be scaled to any size without the onset of pixelization. SVG files used here were created using Inkscape, an excellent graphics program available free on the internet here.

The second new technology used here is MathJax, a Javascript based display engine for mathematical equations programmed in the LaTeX language. MathJax eliminates the need to display equations as GIF or PNG graphics files (or even SVG for that matter). MathJax requires only the following line of code in the <HEAD> segment of a webpage.

```
<script type="text/javascript" src="http://cdn.mathjax.org/mathjax/latest/MathJax.js?config=default"></script>
```

It is then possible to program any math expression in the HTML source using the LaTeX language. For example, typing \(\sigma_{ij}\) produces σ_{ij}.

I'm often asked what software I used to develop the webpages. The answer is... the Vim editor (www.vim.org). Vim is the Windows-based version of the venerable Vi editor on Unix, and now Linux systems. I typed everything by hand.

Bob McGinty

February 2012