Engineering Education in the Age of Web 2.0
— Explorations Through iMechanica.org

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What is **Web 2.0**?

- Phrase was first coined in 2004.
- Referred to a significant change in the way of using the Web.
  - Not a technical upgrade of the Web
- Indicated by a collection of 2\textsuperscript{nd} generation web services
  - Blogs, wikis, social bookmarking, podcasts, RSS…
Web 1.0 vs. Web 2.0

- Web 1.0 was about owning, Web 2.0 is about sharing
- Web 1.0 was about reading, Web 2.0 is about writing
- Web 1.0 was about portals, Web 2.0 is about RSS
- Web 1.0 was about companies, Web 2.0 is about communities
- Web 1.0 was about Netscape, Web 2.0 is about Google
- Web 1.0 was about HTML, Web 2.0 is about XML
- Web 1.0 was about home pages, Web 2.0 is about blogs
- Web 1.0 was about wires, Web 2.0 is about wireless
- Web 1.0 was about dialup, Web 2.0 is about broadband
- Web 1.0 was about hardware, Web 2.0 is about bandwidth
- ...

joedrumgoole.com
Web 2.0 in <5 minutes

A video demo
by Prof. Mike Wesch (Kansas State Univ.)
Web 2.0 services

• Radically change how we obtain, store, access and manage information via Internet

• Bring up new opportunities to innovate how we conduct research and education.

Preliminary explorations of engineering education through

iMechanica.org
iMechanica.org
A Web of Mechanics and Mechanians

Mission
• to use the Internet to enhance communications among mechanicians,
• to pave a way to evolve all knowledge of mechanics online.

• Aims to be the online platform for the discipline of mechanics.
• Will not only preserve knowledge in mechanics, but also influence its future development.
• In steady state, the discipline and its online platform will co-evolve.
Some numbers of iMechanica.org

- Launched on 9 September 2006

As of 9 November 2007
- 4336 registered users from all over the world
- 8,000,000+ web hits
- 21,000+ daily web hits since Jan. 2007
- 2276 posts, 5808 comments
- These numbers are still steadily increasing
HOW DOES iMechanica WORK?

- All contents are contributed by registered users.
- All contents are freely accessible to everyone in the world.
- Every registered user has her own blog.
- Contents are aggregated into Channels.

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A glance of iMech Education Channel

Computational Solid Mechanics Summer School: 26 Aug - 1 Sep 2007, Glasgow UK

Mathematical Modelling & Computational Methods in Solid Mechanics
26th August - 1st September 2007
University of Glasgow

Registration is now open for a Summer School on Mathematical Modelling & Computational Methods in Solid Mechanics. This week-long event is to take place at Glasgow University, UK, between 26th August and 1st September 2007. The material covered will address both basic and advanced topics within computational solid mechanics. Speakers include Professors Ray Ogden, Nenad Hitcetic, Harm Askes, Marc Geers and Gerhard Holzapfel.

• Writing a post in iMech is as easy as writing an email
• Commenting on a post is as easy as replying an email

Does a radially expanding cylinder bend?

The Koiter-Sanders-Budiansky bending strain measure and the question of classification

We know from strength of materials that non-uniform stretching of fibers along the cross section of a beam produces bending moments. But does this situation necessarily correspond to a 'bending' deformation? For that matter, what do we exactly mean kinematically when we talk about a bending deformation?

To make the question more concrete, consider a cylinder that expands uniformly along all radial rays. Does this deformation of the cylinder correspond to bending? I think it is fair to say that most would say that this is purely a stretching deformation with no bending. But then, what is precisely a bending deformation?

Review of a few "Unified" Viscoplasticity Models (Motivated by solder deformation)
Submitted by Dhruv Bhave on Mon, 2007-05-14 00:03.

I had prepared this document for a class project, the level is introductory and the selection of models is motivated by solder deformation, but I hope it is of some help. I have examined four models, proposed by Hart, Anand, Kreinpl and Busso. The document has 16 pages.

Thanks,
Dhruv
- Wide range of formats of contents
  - Plain texts, images, .doc, .pdf, .ppt and even YouTube videos!
- Some post, others comment
  - Number of comments is ~twice of that of posts
  - Real time update on side bar
  - Popular posts recommendations

Journal Club Theme of May 2007: Experimental Mechanics of Nanobuilding Blocks
Submitted by Xiaodong Li on Mon, 2007-04-30 21:07.

Welcome to the May 2007 issue. This issue focuses on experimental nanomechanics of nanobuilding blocks. The extremely small dimensions of nanobuilding blocks (for instance, nanoparticles, nanotubes, and nanowires) have imposed great challenges to many existing instruments, methodologies, and even theories. In this issue, we will discuss – (1) experimental techniques and (2) size-effects.

- Broad audience
- Active interaction

» 69 comments | Read more | 7119 reads
Management of iMechanica

• Hosted on a server at the School of Engineering and Applied Sciences, of Harvard University.

• A growing team of volunteers serve as architects, moderators, and developers.
Engineering Education in the Age of Web 2.0

- iMechanica provides a Web 2.0-enabled platform
- Researchers, educators and students can experiment innovative ideas on engineering education.

Following are some examples
Course Webpage 1.0

- Traditional Web 1.0 course websites are *static* and *one-way*.
  - Instructor posts and students download.
  - No interactive communication

- Blackboard-type course websites offer discussion boards, but have limited access.
  - No discussion accumulated over the time.

- Maintenance and updates can be burdensome
  - HTML, server access for uploading, etc.
Interactive Course Webpage 2.0

- Tags aggregating contents
- Offered at 2 campuses
- Hyperlinks to related contents

Home » blogs » John W. Hutchinson's blog

Engineering Sciences 242r - Engineering Mechanics and Composite Materials

View | Edit | Revision | Track


Time: Thursday and Tuesday, 1:30-3:00 pm (Harvard University), 12:30-2:20 pm (University of Nebraska).
First meeting: 1 February

Place: Harvard University Teaching Center, 111 Walter Scott Engineering Center

Course website (this page): http://imechanica.org/node/754

Instructors

- John W. Hutchinson, (617) 495-2848, hutchinson@husm.harvard.edu, Pierce 315, Skype: johnwhutchinson
- Zhigang Suo, 617-495-3789, suo@deas.harvard.edu, Pierce 309, Skype: zhigang suo

Teaching fellows

- Zhen Zhang, (617)-384-7894, zhangz@deas.harvard.edu, Pierce Hall 406, Skype: flyinskypku.
- Xiangfa Wu, (402)-472-1680, xfwu@unlserve.unl.edu, W317.4, Nebraska Hall. Office Hour: Thursday 2:15-5:00 pm, Skype: xiang-fa.

Students and why they take this course.

- Lectures
- Homework Sets
- Auxiliary notes
Interacting via course webpage

• All course contents are open to public.

• Any interested learners can view, download and study the course contents.

• Learners can raise questions on any individual lecture notes or homework sets.

• Such questions can be answered by instructors, another student, or any experienced iMechanica users in the world.

Interaction extends beyond instructors and students to any pair of educator and learner
Stay current via RSS feeds

• Course contents keep evolving ever since.

• Dynamic interactions will be accumulated and available to any future educators and learners.

• All course contents, including main webpage, individual lectures, have their unique **RSS feeds**.
  – By subscribing these RSS feeds, users keep alerted of any new content added to the course.

• Comments can also be subscribed via a unique RSS feed.
  – Stay current with any new discussions.
Let’s compare lecture notes!
Curriculum comparison and consolidation

<table>
<thead>
<tr>
<th>Lecture notes of interest to mechanicians</th>
</tr>
</thead>
<tbody>
<tr>
<td>View</td>
</tr>
</tbody>
</table>

Notes to everyone:

- If you find helpful lecture notes online, please leave a comment below.
- iMechanica moderators will examine your suggestion and add to this page.
- RSS feed to all comments on this page: http://imechanica.org/css/node/1551

Mathematics for Mechanics

- A Brief Review of Some Mathematical Preliminaries, Rohan Abeyaratne, MIT.
- Quick Introduction to Tensor Analysis, R. A. Shapirov, Samizdat Free Press.
- Elementary vector and tensor analysis for Engineers, Rebecca Brannon, University of Utah.
- Rotations, Rebecca Brannon, University of Utah.
- Curvilinear coordinates, Rebecca Brannon, University of Utah.

Introductory Mechanics of Materials/Material Behavior

- Materials of Engineering Laboratory, Eyassu Woldesenbet and Herry Tan, Louisiana State University.
- Statics (Homework Sets), Jacob Lubliner, UC Berkeley.

Continuum Mechanics

- Items developed for teaching, James R. Rice, Harvard University
- ES 240 Solid Mechanics, Zhigang Suo, Harvard University.
Public outreach in the age of Web 2.0

*Traditional public outreach*

- **One-way** information flow
  - only from scientists to K-12 students/teachers
- **Limited** scale and impact
  - Geographical, budget, time constraints

*Public outreach 2.0*

- **Two-way** information flow
  - both parties to reach out to each other
- **Much broader** scale and impact
  - Students benefit from community-wide wisdom
- iMechanica is a **free** service
Flexible Macroelectronics (a video for middle school kids)
Submitted by Teng Li on Thu, 2007-05-10 12:00.

This is a winning entry in the Sci/Terp Video Competition at University of Maryland (UMD).

- A picture is worth of 1000 words, a video is worth even more...
- Embedding YouTube videos in iMechanica can be as easy as several clicks
- iMech video channel integrates mechanics-related videos for scientific research and public outreach
K-12, college, graduate school and beyond

- Engineering education is a life-long process
- Engineering education beyond graduate school often relies on self learning
  - Limited scope and time-constraint
- iMechanica brings mechanicians of common interests together and serves as a platform for discussions and interactions.
  - No institutional boundaries
  - Evolving all the time
  - Real time updates
Summary

• **iMechanica**: a platform to experiment innovative ideas on engineering research and education

• Building an online life-long learning environment without boundary.
  – Not limited within a specific institution/curriculum
  – Anyone can participate, as either an instructor or a student, or both

• Harnessing community-wide wisdom

• Applicable to many other disciplines

Join us at iMechanica.org, and explore!
Acknowledgement

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• ASME Applied Mechanics Division
• iMechanica users for participation and guidance

Paper available at: http://imechanica.org/node/1472