

Engineering Education in the Age of **Web 2.0**

— Explorations Through **iMechanica.org**

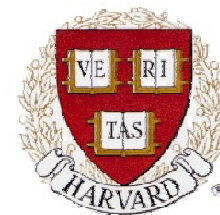
Teng Li

University of Maryland



Z. Suo

Harvard University

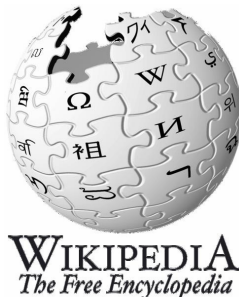


Presented at  **ASME** IMECE2007
SETTING THE STANDARD

19 November 2007

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 2nd generation web services
 - Blogs, wikis, social bookmarking, podcasts, RSS...



Web 1.0 vs. Web 2.0

- Web 1.0 was about owning,
- Web 1.0 was about reading,
- Web 1.0 was about portals,
- Web 1.0 was about companies,
- Web 1.0 was about Netscape,
- Web 1.0 was about HTML,
- Web 1.0 was about home pages,
- Web 1.0 was about wires,
- Web 1.0 was about dialup,
- Web 1.0 was about hardware,
- ...

Web 2.0 is about sharing
Web 2.0 is about writing
Web 2.0 is about RSS
Web 2.0 is about communities
Web 2.0 is about Google
Web 2.0 is about XML
Web 2.0 is about blogs
Web 2.0 is about wireless
Web 2.0 is about broadband
Web 2.0 is about bandwidth
...

WEB 2.0 Landscape

Widget/
component

WEB APPLICATION

Aggregation/
recombination

CONTENT
SHARING

RECOMMENDATIONS/
FILTERING

Rating/
Tagging

Collaborative
filtering

FUTURE

SOCIAL NETWORK



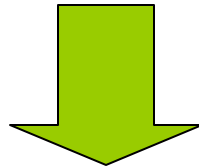
Web 2.0 in <5 minutes

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 Mechanicians

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?

The screenshot shows the iMechanica website. At the top, a navigation bar contains links for 'research', 'education', 'classic', 'mechanician', 'opinion', 'software', 'industry', 'conference', 'job', 'tip', and 'video', all enclosed in a red oval. On the left, a user profile for Jane W. Smith is shown with a red oval around her 'My blog' section, which lists 'Post a new blog entry', 'Post a new forum topic', and 'Post a new image'. A red arrow points from this section to a text box. The main content area features a 'Journal Club' post about 'Experimental Mechanics' by Xiaodong Li, with a red arrow pointing from a text box to it. Below this is a post about 'SES 2007 - Symposium on the mechanics of thin films and layered materials' by Nancy Sottos. On the right, there is a 'Quick guide' section with links to 'About iMechanica', 'Journal Club', 'FAQ', and 'Community standards', and a 'Recent comments' section listing various topics and their timestamps. At the bottom left, a 'Popular content' section lists items like 'free pre-post processor' and 'Google will videotape all Harvard classes'. A red arrow points from a text box to the 'My blog' section of Jane W. Smith's profile.

Contents are aggregated into Channels

Every registered user has her own blog

All contents are contributed by registered users
All contents are freely accessible to everyone in the world

A glance of iMech Education Channel

education

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

Submitted by [Chris Pearce](#) on Wed, 2007-05-16 14:48. [education](#)

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 Bicanic, Harm Askes, Marc Geers and Gerhard Holzapfel.



» [Chris Pearce's blog](#) | [Add new comment](#) | [Read more](#) | 24 reads | [1 attachment](#)

Does a radially expanding cylinder bend?

Submitted by [Amit Acharya](#) on Tue, 2007-05-15 12:42. [education](#) | [research](#) | [shell theory](#)

The Koiter-Sanders-Budiansky bending strain measure and its relation to the bending deformation.

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?

» [Amit Acharya's blog](#) | [Add new comment](#) | [Read more](#) | 248 reads | [1 attachment](#)

Tags



Attachments

Review of a few "Unified" Viscoplasticity Models (Motivated by solder deformation)

Submitted by [Dhruv Bhat](#) on Mon, 2007-05-14 08:03. [education](#) | [Anand](#) | [Busso](#) | [Hart](#) | [Krempel](#) | [viscoplasticity](#)

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, Krempel and Busso. The document has 16 pages.

Thanks,
Dhruv



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

Submitted by [Biswajit Banerjee](#) on Sun, 2007-05-13 21:21. [education](#) | [continuum mechanics](#) | [derivatives](#) | [invariants](#)

When you first start learning finite deformation plasticity, you will run into a plastic flow rate d_p that can be derived from a flow potential ϕ such that



- 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. [research](#) | [experimental mechanics](#) | [Journal Club Forum](#)
[| nano](#) | [nanomaterials](#)



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.

» [69 comments](#) | [Read more](#) | 7119 reads

- **Broad audience**
- **Active interaction**

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

[Home](#) » [blogs](#) » [John W. Hutchinson's blog](#)

Engineering Sciences 24
Composite Materials

Tags aggregating contents

[View](#)

[Edit](#)

[Revisions](#)

[Track](#)

Submitted by [John W. Hutchinson](#) on Sat, 2007-01-27 14:17.

[education](#) | [ES 242r](#) | [fracture](#)

[mechanics](#) | [lecture notes](#) | [Spring 2007](#)

Time. Thursday and Tuesday, 1:30-3:00 pm (Harvard University) 12:30-2:2:00 pm
(University of Nebraska) First meeting: 1 February 2007

Place. Harvard University Engineering Center 111 Walter Scott

Offered at 2 campuses

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**: zhigangsuo

Teaching fellows

- [Zhen Zhang](#), (617)-384-7894, zhangz@deas.harvard.edu, Pierce Hall 406, **Skype**: flyinskykpu.
- [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](#)

Hyperlinks to related contents

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

Lecture notes of interest to mechanicians

[View](#)

[Revisions](#)

Submitted by [Managers](#) on Wed, 2007-06-13 12:04. [Mechanics Courses Forum](#) | [education](#) | [lecture notes](#)

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/crss/node/1551>

Mathematics for Mechanics

- [A Brief Review of Some Mathematical Preliminaries](#), Rohan Abeyaratne, MIT.
- [Quick Introduction to Tensor Analysis](#), R. A. Shapiro, 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

- [Introductory Mechanics of Materials](#), M. A. Vable, Michigan Tech.
- [Intermediate Mechanics of Materials](#), M. A. Vable, Michigan Tech.
- [Materials of Engineering Laboratory](#), Eyassu Woldesenbet and Henry Tan, Louisiana State University.
- [Statics \(Homework Sets\)](#), Jacob Lubliner, UC Berkeley.
- [Mechanics of Materials](#), Jacob Lubliner, UC Berkeley.

Continuum Mechanics

- [Items developed for teaching](#), James R. Rice, Harvard University
- [ES 240 Solid Mechanics](#), Zhigang Suo, Harvard University.

- More than 12 mechanics branches
- More than 60 course lecture notes
- Contents keep increasing

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

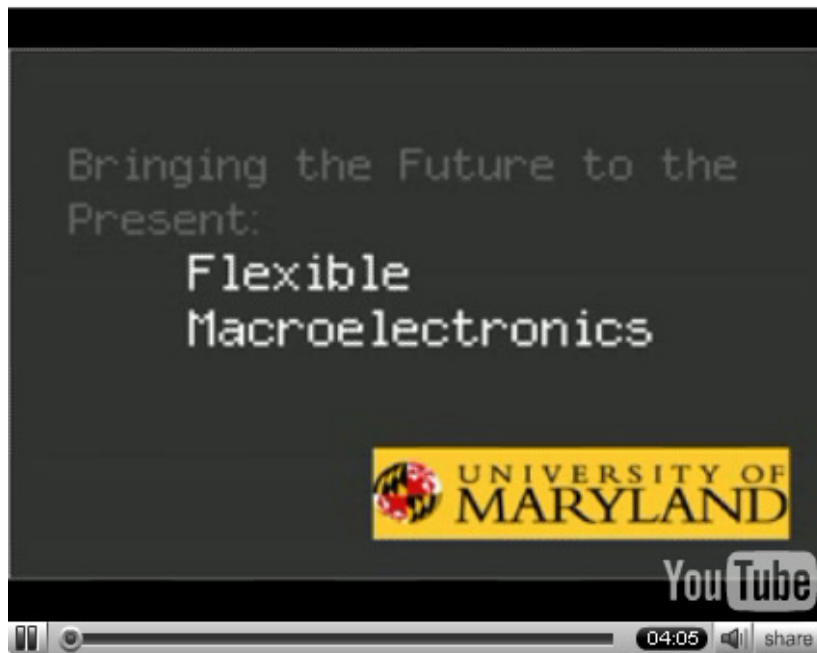
- Two-way information flow
 - both parties to reach out to each other
- Much broader scale and impact
 - Students benefit from community-wide wisdom
- iMechanica is a free service

YouTube for Education

Flexible Macroelectronics (a video for middle school kids)

Submitted by [Teng Li](#) on Thu, 2007-05-10 12:00. [video](#) | [education](#) | [flexible electronics](#) | [K12](#) | [macroelectronics](#)

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

» [Add new comment](#) | [Read more](#) | 204 reads

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

- Harvard School of Engineering and Applied Sciences
 - Lesley Lam and Jayanta Sircar, of the Information Technology Office
- ASME Applied Mechanics Division
- iMechanica users for participation and guidance

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