

Leveraging Online and Technology ~~Trends~~ **Disruptions** to Transform Engineering Education

Jim Tung
jim@mathworks.com

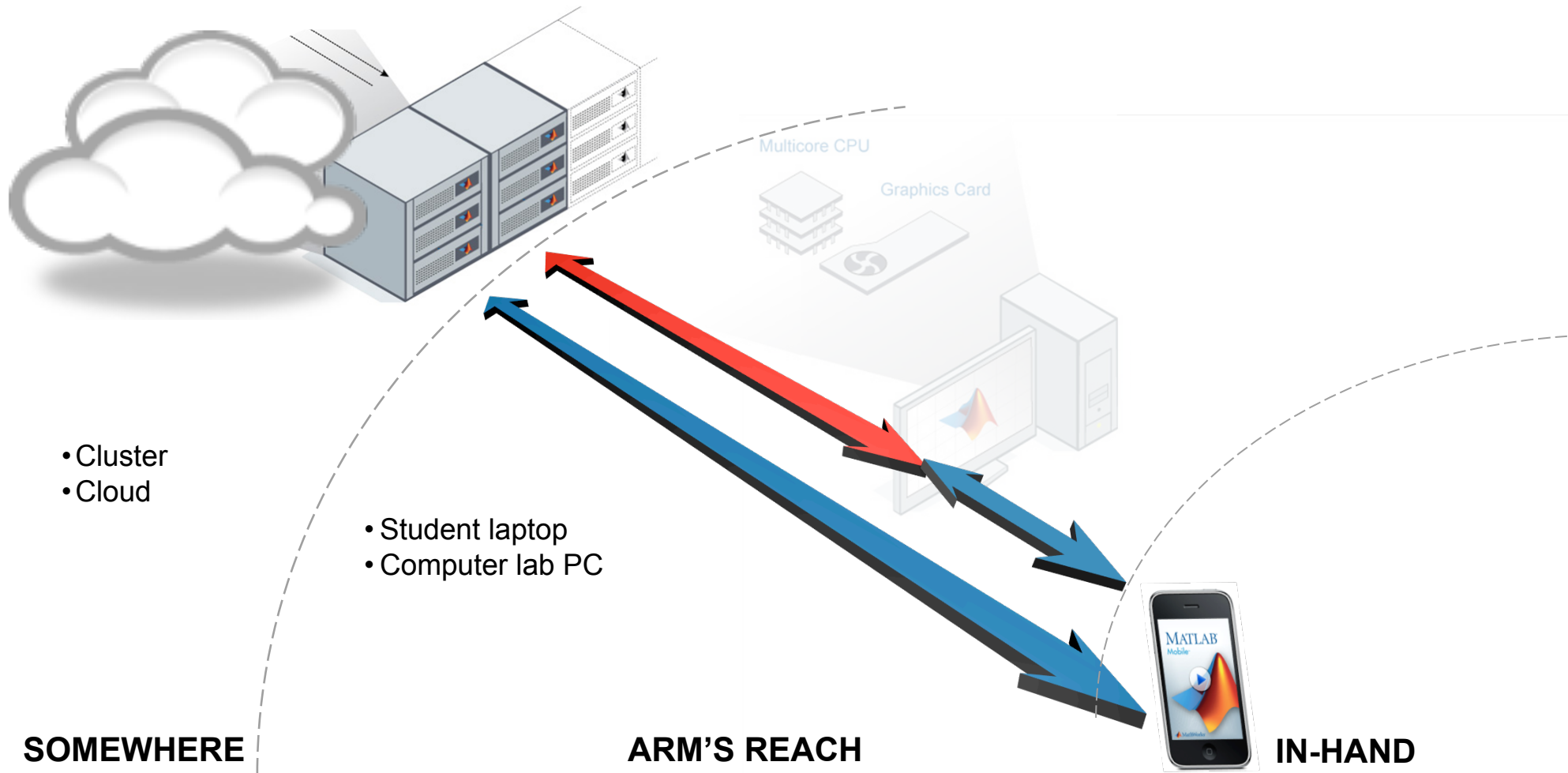
Accelerating the Pace of Adoption of Educational Innovations

Trend: Computing resources in flux

- Students will have laptops and/or tablets
- Students may or may not be physically on campus to use labs
- Students want and expect to work from anywhere
- Computer labs shrinking or disappearing, or reserved for physical experiments
- Servers and clouds (private and public) at various stages of implementation and use
- Learning “in place” is redefined
- Distance learning → Equidistance learning?

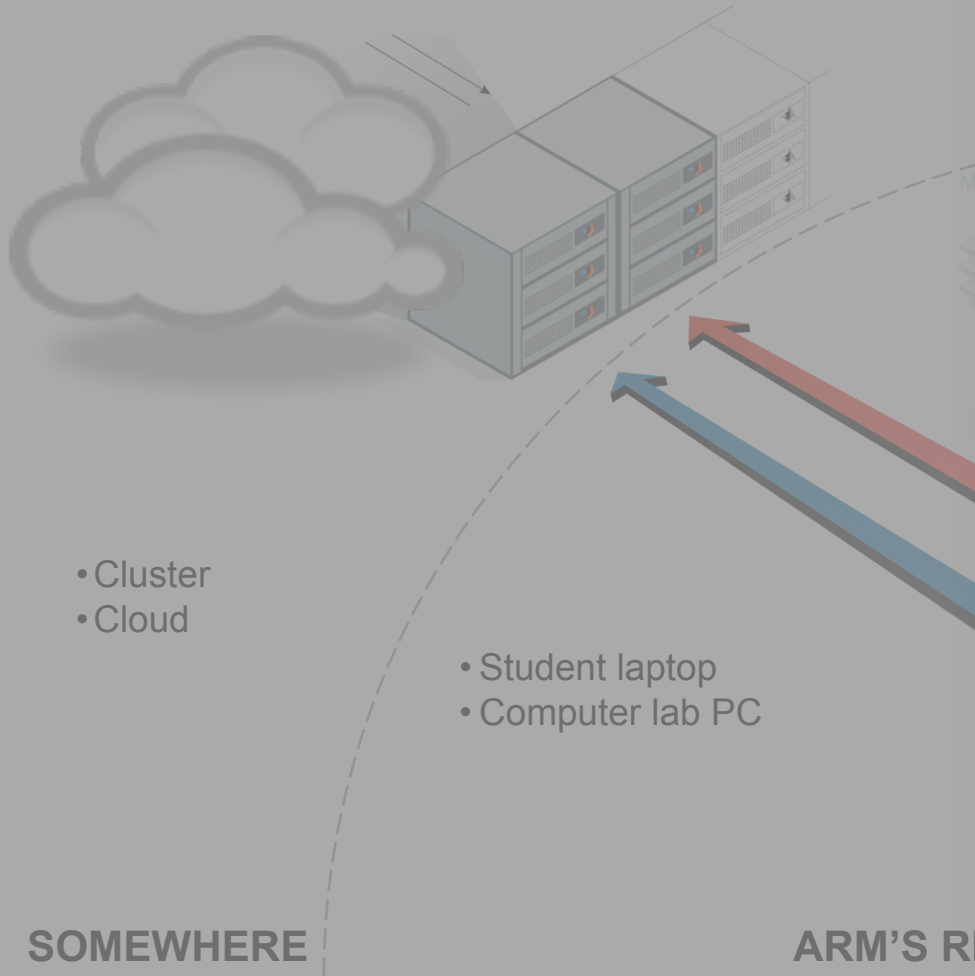
Trend: Computing resources in flux

Response: Provide as much flexibility as possible



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Trend: Hands-on is fun, engaging, and instructional

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Trend: Lots of readily-accessible hardware

Response: Personal real-time systems for students

Inexpensive Processors



Easy-to-Build Devices

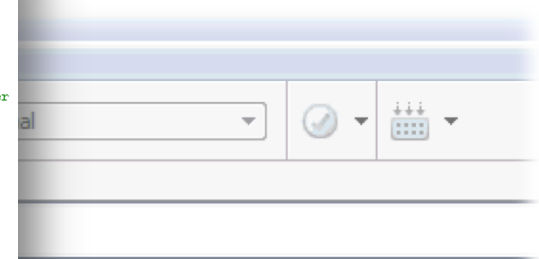


Consumer Products



```

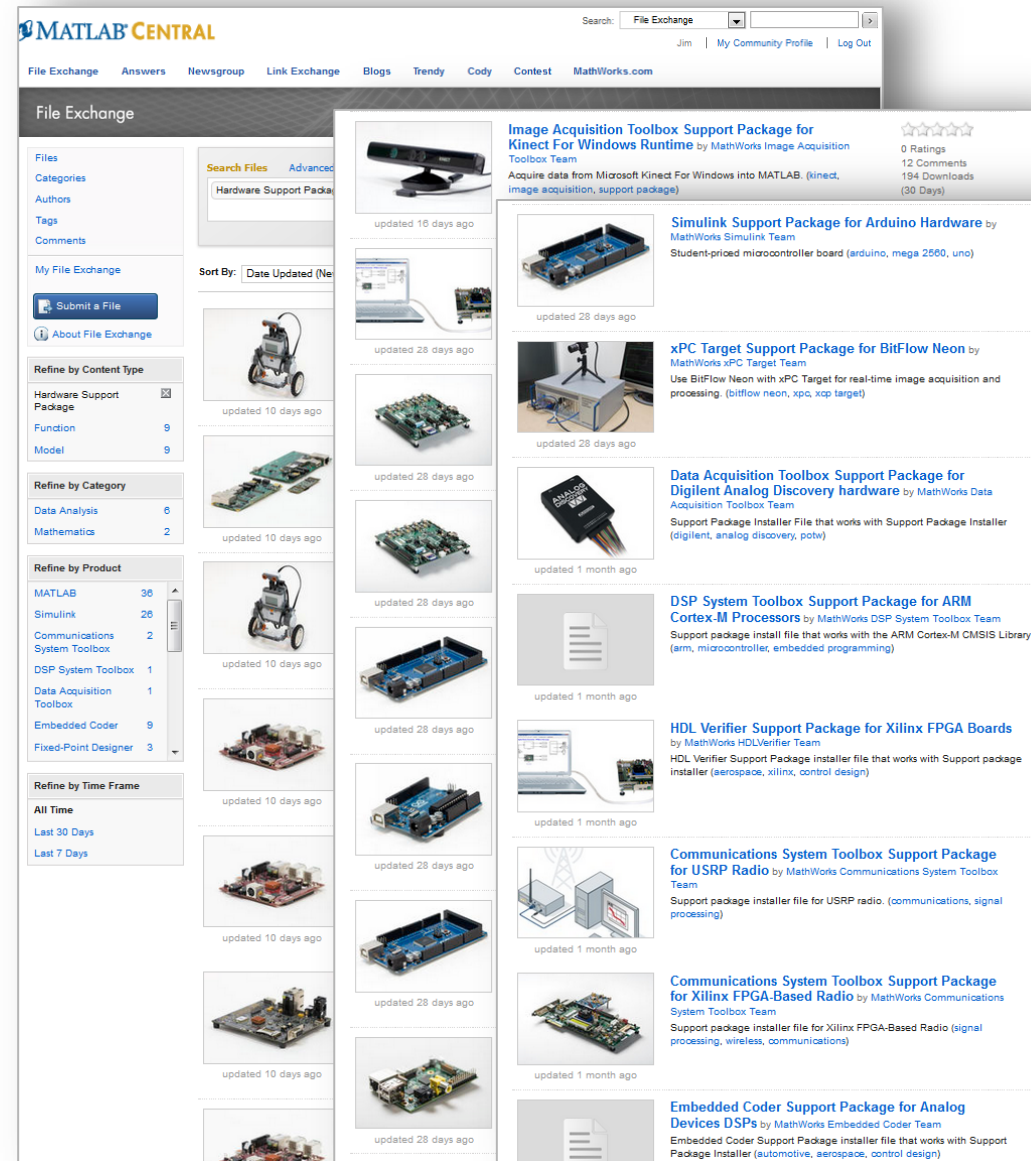
BOOL CMyMfc29BAuto::DisplayDialog()
{
    // TODO: Add your dispatch handler code here
    TRACE("Entering CMyMfc29BAuto::DisplayDialog %p\n", this);
    BOOL bRet = TRUE;
    AfxLockTempMaps(); // See MFC Tech Note #3
    CWnd* pTopWnd = CWnd::FromHandle(::GetTopWindow(NULL));
    try
    {
        CPromptDlg dlg /*(pTopWnd)*/;
        if (m_vaTextData.vt == VT_BSTR)
        {
            // converts double-byte character to single-byte character
            dlg.m_strData = m_vaTextData.bstrVal;
        }
        dlg.m_lData = m_lData;
        if (dlg.DoModal() == IDOK)
        {
            m_vaTextData = COleVariant(dlg.m_strData).Detach();
            m_lData = dlg.m_lData;
            bRet = TRUE;
        }
        else
        {
            bRet = FALSE;
        }
    }
    catch (CException* pe)
    {
        TRACE("Exception: failure to display dialog\n");
        bRet = FALSE;
        pe->Delete();
    }
    AfxUnlockTempMaps();
    return bRet;
}
    
```



Trend: Hands-on is fun, engaging, and instructional

Trend: Lots of readily-accessible hardware

- Open-source hardware
- Mass-market systems
- Education-oriented systems
- Industry-proven systems



The screenshot displays the MATLAB Central File Exchange interface. The page title is "File Exchange" and it shows a search bar with "File Exchange" entered. The user is identified as "Jim" with options for "My Community Profile" and "Log Out".

The main content area is a grid of file listings. Each listing includes a thumbnail image, the file name, the author/team, a brief description, and the date it was updated. The files listed include:

- Image Acquisition Toolbox Support Package for Kinect For Windows Runtime** by MathWorks Image Acquisition Toolbox Team (updated 18 days ago)
- Simulink Support Package for Arduino Hardware** by MathWorks Simulink Team (updated 28 days ago)
- xPC Target Support Package for BitFlow Neon** by MathWorks xPC Target Team (updated 28 days ago)
- Data Acquisition Toolbox Support Package for Digilent Analog Discovery hardware** by MathWorks Data Acquisition Toolbox Team (updated 1 month ago)
- DSP System Toolbox Support Package for ARM Cortex-M Processors** by MathWorks DSP System Toolbox Team (updated 1 month ago)
- HDL Verifier Support Package for Xilinx FPGA Boards** by MathWorks HDLVerifier Team (updated 1 month ago)
- Communications System Toolbox Support Package for USRP Radio** by MathWorks Communications System Toolbox Team (updated 1 month ago)
- Communications System Toolbox Support Package for Xilinx FPGA-Based Radio** by MathWorks Communications System Toolbox Team (updated 1 month ago)
- Embedded Coder Support Package for Analog Devices DSPs** by MathWorks Embedded Coder Team (updated 28 days ago)

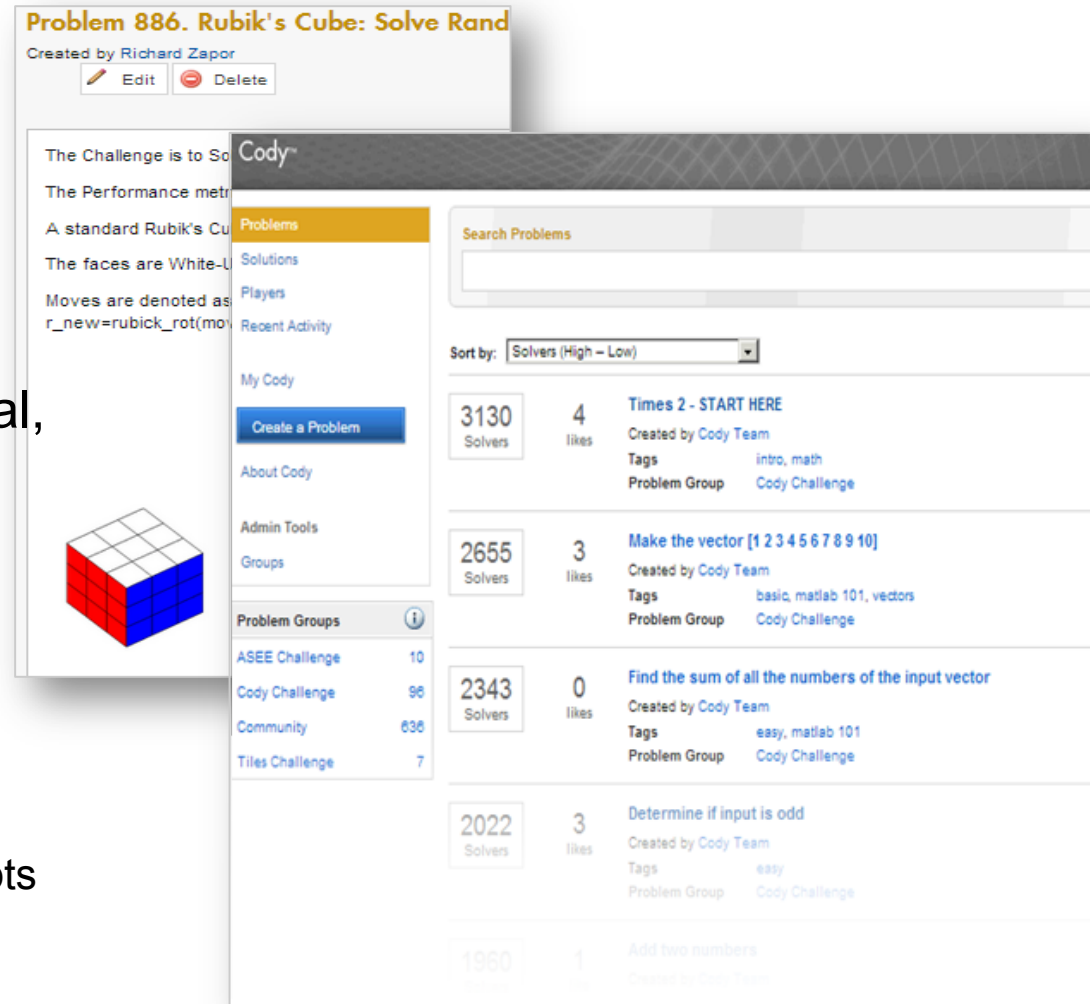
On the left side, there are navigation and filtering options:

- Files**: Categories, Authors, Tags, Comments
- My File Exchange**: Submit a File, About File Exchange
- Refine by Content Type**: Hardware Support Package (9), Function (9), Model (9)
- Refine by Category**: Data Analysis (6), Mathematics (2)
- Refine by Product**: MATLAB (36), Simulink (26), Communications System Toolbox (2), DSP System Toolbox (1), Data Acquisition Toolbox (1), Embedded Coder (9), Fixed-Point Designer (3)
- Refine by Time Frame**: All Time, Last 30 Days, Last 7 Days

Trend: On-Line Content for Learning and Assessment

Response: Interaction, Gamification, Authoring

- Use on-line or in MATLAB
- Motivates learning with social, scoring, badges, ranking, progress & feeds
- First 16 months online:
 - Over 1000 problems created
 - Over 14,000 players
 - Over 225,000 solution attempts



Problem 886. Rubik's Cube: Solve Rand
Created by Richard Zapor

The Challenge is to Solve...
The Performance metric...
A standard Rubik's Cube...
The faces are White-Blue...
Moves are denoted as...
`r_new=rubick_rot(mov)`

Cody

Search Problems

Sort by: Solvers (High - Low)

Solvers	likes	Problem Title
3130	4	Times 2 - START HERE
2655	3	Make the vector [1 2 3 4 5 6 7 8 9 10]
2343	0	Find the sum of all the numbers of the input vector
2022	3	Determine if input is odd
1960	1	Add two numbers

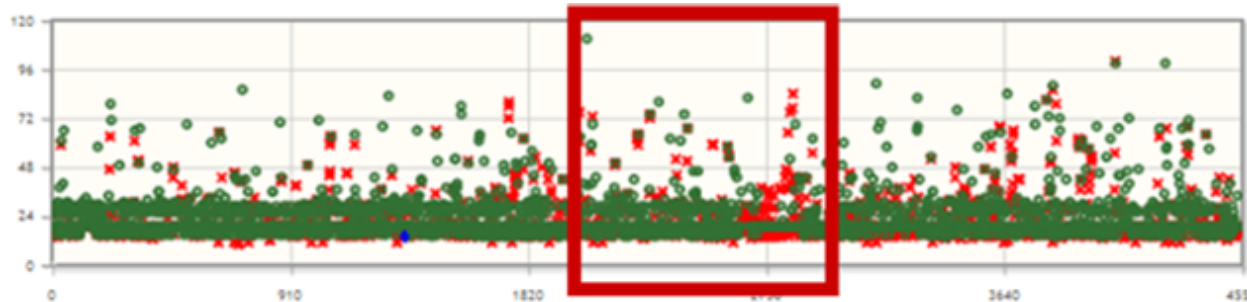
Problem Groups

Group	Count
ASEE Challenge	10
Cody Challenge	96
Community	636
Tiles Challenge	7

Trend: On-Line Content for Learning and Assessment

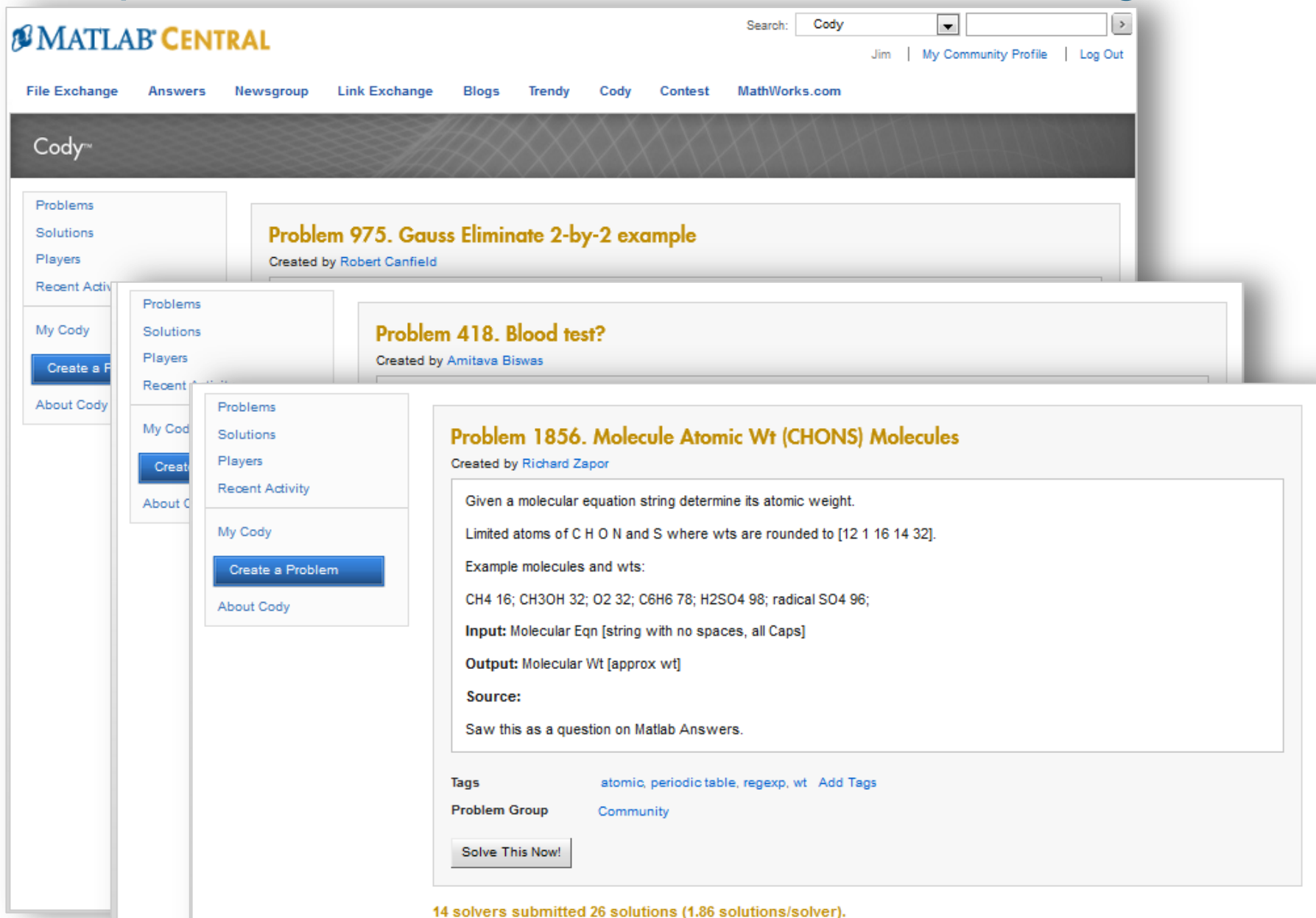
Response: Interaction, Gamification, Authoring

- Try out new problems on the user community, not students
- Quickly see learning gaps meriting lecture follow-up



Trend: On-Line Content for Learning and Assessment

Response: Interaction, Gamification, Authoring



The screenshot displays the MATLAB Central Cody interface. At the top, there is a search bar with 'Cody' entered and navigation links for 'Jim', 'My Community Profile', and 'Log Out'. Below the search bar is a horizontal menu with links: 'File Exchange', 'Answers', 'Newsgroup', 'Link Exchange', 'Blogs', 'Trendy', 'Cody', 'Contest', and 'MathWorks.com'. The main content area is titled 'Cody™' and features a sidebar on the left with links for 'Problems', 'Solutions', 'Players', 'Recent Activity', 'My Cody', and 'About Cody'. A 'Create a Problem' button is visible in the sidebar.

The main content area displays a list of problems. The first problem is 'Problem 975. Gauss Eliminate 2-by-2 example' created by Robert Canfield. The second problem is 'Problem 418. Blood test?' created by Amitava Biswas. The third problem is 'Problem 1856. Molecule Atomic Wt (CHONS) Molecules' created by Richard Zapor. This problem is expanded to show its details:

Problem 1856. Molecule Atomic Wt (CHONS) Molecules
 Created by Richard Zapor

Given a molecular equation string determine its atomic weight.
 Limited atoms of C H O N and S where wts are rounded to [12 1 16 14 32].
 Example molecules and wts:
 CH₄ 16; CH₃OH 32; O₂ 32; C₆H₆ 78; H₂SO₄ 98; radical SO₄ 96;

Input: Molecular Eqn [string with no spaces, all Caps]
Output: Molecular Wt [approx wt]
Source:
 Saw this as a question on Matlab Answers.

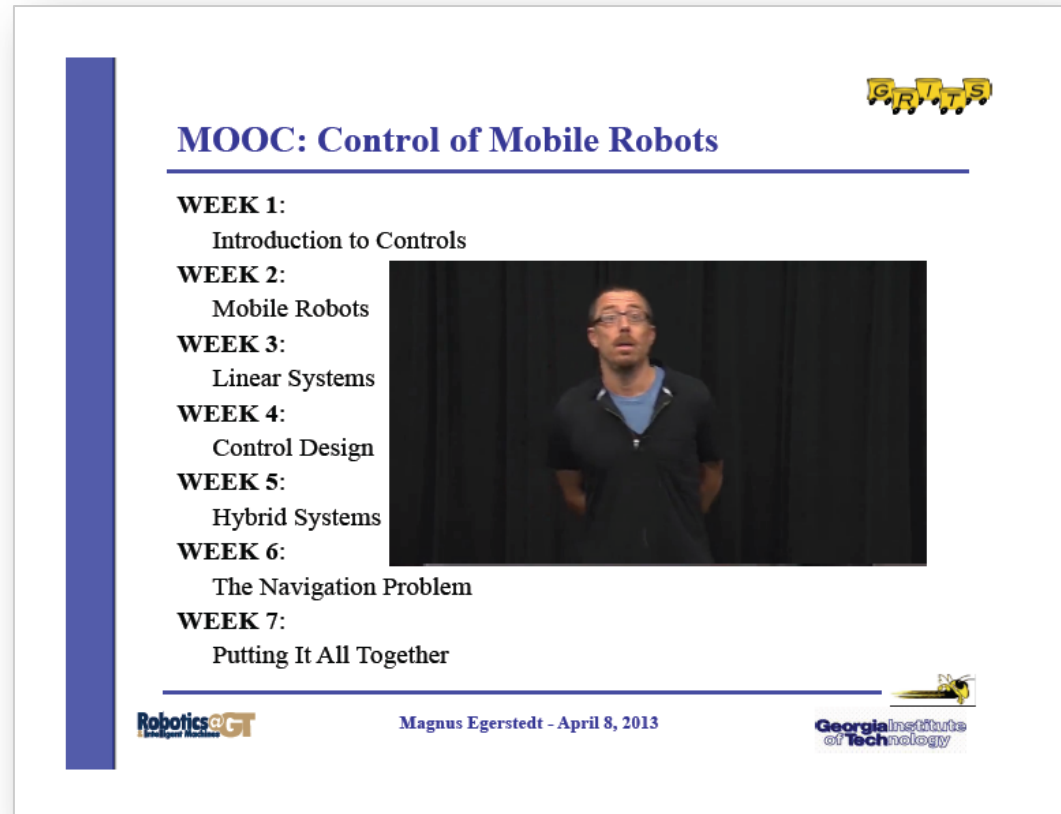
Tags: [atomic](#), [periodic table](#), [regex](#), [wt](#) [Add Tags](#)
 Problem Group: [Community](#)

14 solvers submitted 26 solutions (1.86 solutions/solver).

Trend: MOOCs and Blended Learning

Response: Make MATLAB Accessible

- Download MATLAB onto student-owned computers
- Offer Student Version to MOOC course attendees



MOOC: Control of Mobile Robots

WEEK 1:
Introduction to Controls

WEEK 2:
Mobile Robots

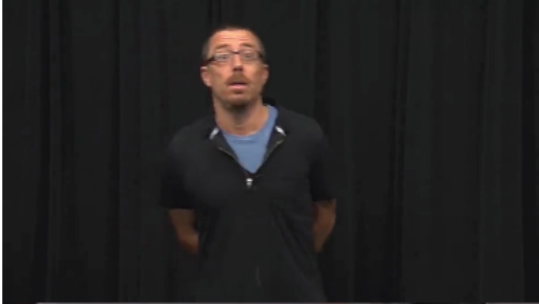
WEEK 3:
Linear Systems

WEEK 4:
Control Design

WEEK 5:
Hybrid Systems

WEEK 6:
The Navigation Problem

WEEK 7:
Putting It All Together



Robotics@GT Magnus Egerstedt - April 8, 2013 Georgia Institute of Technology

Trend: MOOCs and Blended Learning Response: Make MATLAB Accessible

- Interactive MATLAB programming in the MOOC platform, leveraging features for assignments and auto-grading

GmTo
3 months ago 5



```

clf;
L=0.5;
t=2e-3;
d_A=4e-2;
G=70e9;
gammaMax=2e-2;
Q_0 = gammaMax*pi*t*d_A^2/2;
r_A=d_A/2;
eps=r_A/100; %just for graphics reasons
k=10; %mesh torsion magnification factor
r=linspace(r_A,2*r_A,100);
theta=linspace(0,2*pi,40);
[r,theta]=meshgrid(r,theta);
x=L*(r-r_A)/r_A;
phi=2*Q_0*L/(pi*t*d_A^3)*(1-(L/(L+x)).^2);
z=(r+eps).*sin(theta+k*phi); %mesh torsion magnified by k
y=(r+eps).*cos(theta+k*phi); %mesh torsion magnified by k
gamma = 2/pi*Q_0/(G*t*d_A^2)*(L/(L+x)).^2;
surf(100*x,100*y,100*z,100*gamma);
grid on;
view(45,30);
axis equal;
cb=colorbar;
ylabel(cb,'shear strain [%]');
title('SHEAR STRAIN OF A TAPERED THIN-WALL SHAFT','FontWeight','bold');
xlabel('x [cm]');
ylabel('y [cm]');
zlabel('z [cm]');
set(gca,'xlabel','position',[20,-8,-4]);
set(gca,'ylabel','position',[54,-2,-4]);
text(30,6,4,'Angle of twist is magnified');
    
```

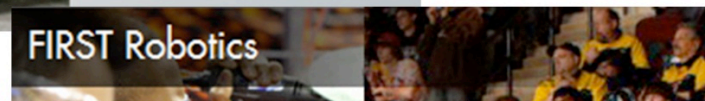
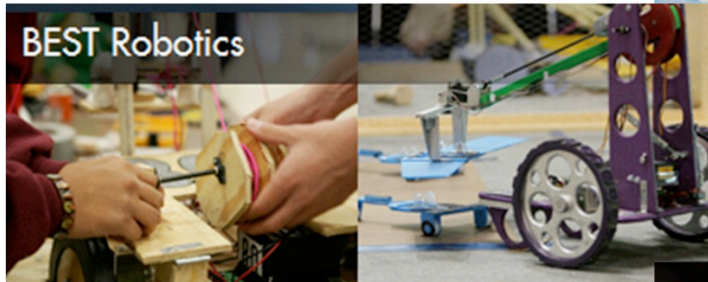
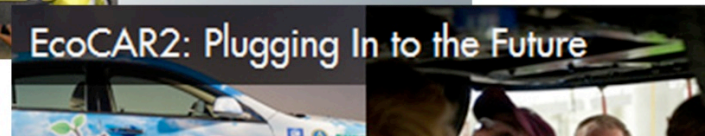
[Report Misuse](#)

Oh yeah! Good stuff!
-posted 3 months ago by larrymud □

Cool!
-posted 3 months ago by Olivia_Fang □

awesome!
-posted 3 months ago by donnaamor □

Trend: Proliferation of student competitions



Trend: Proliferation of student competitions

Response: More... smaller-scale, virtualized

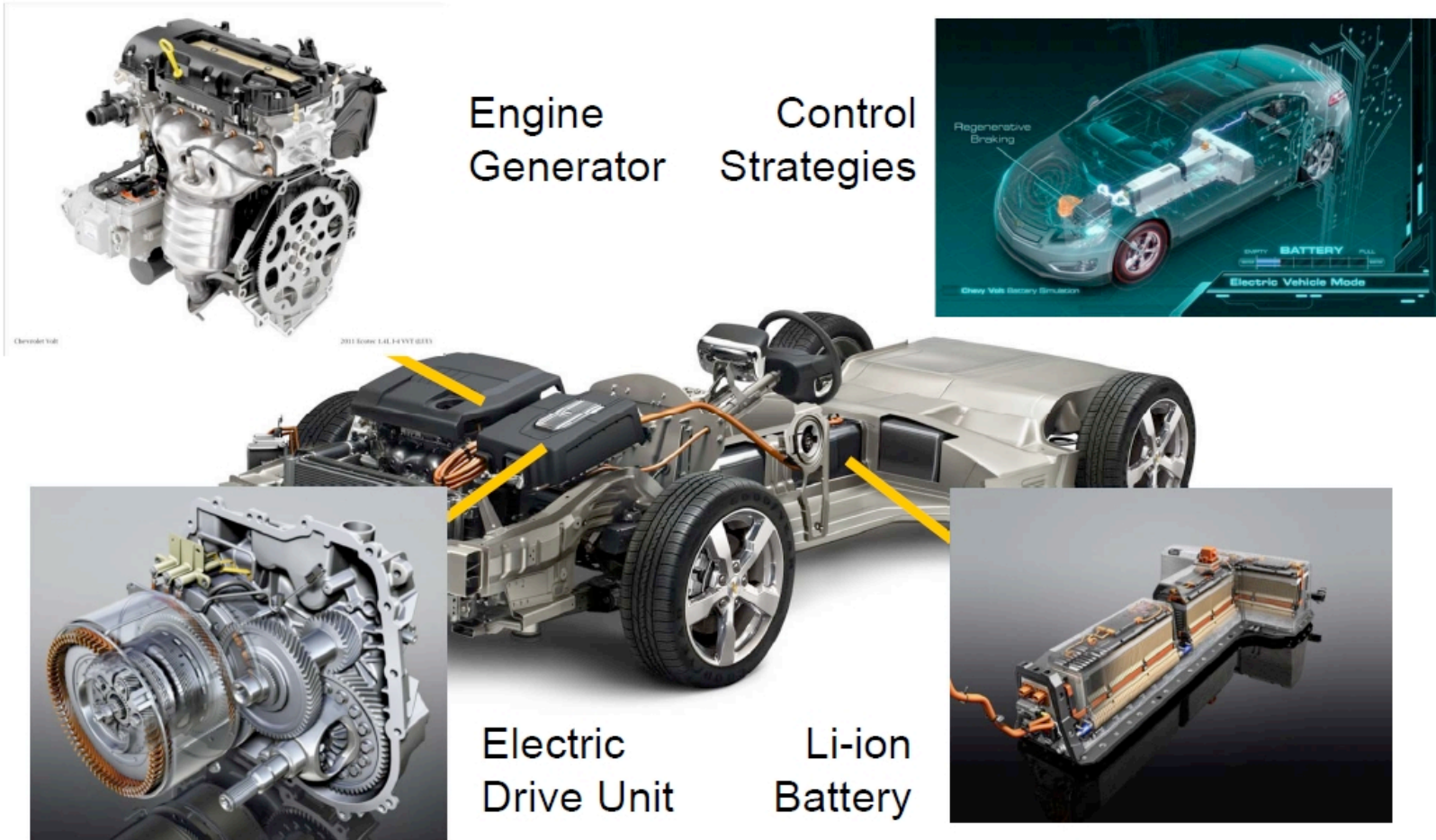


Trend: Focus on the system level in industry

Chevrolet Volt

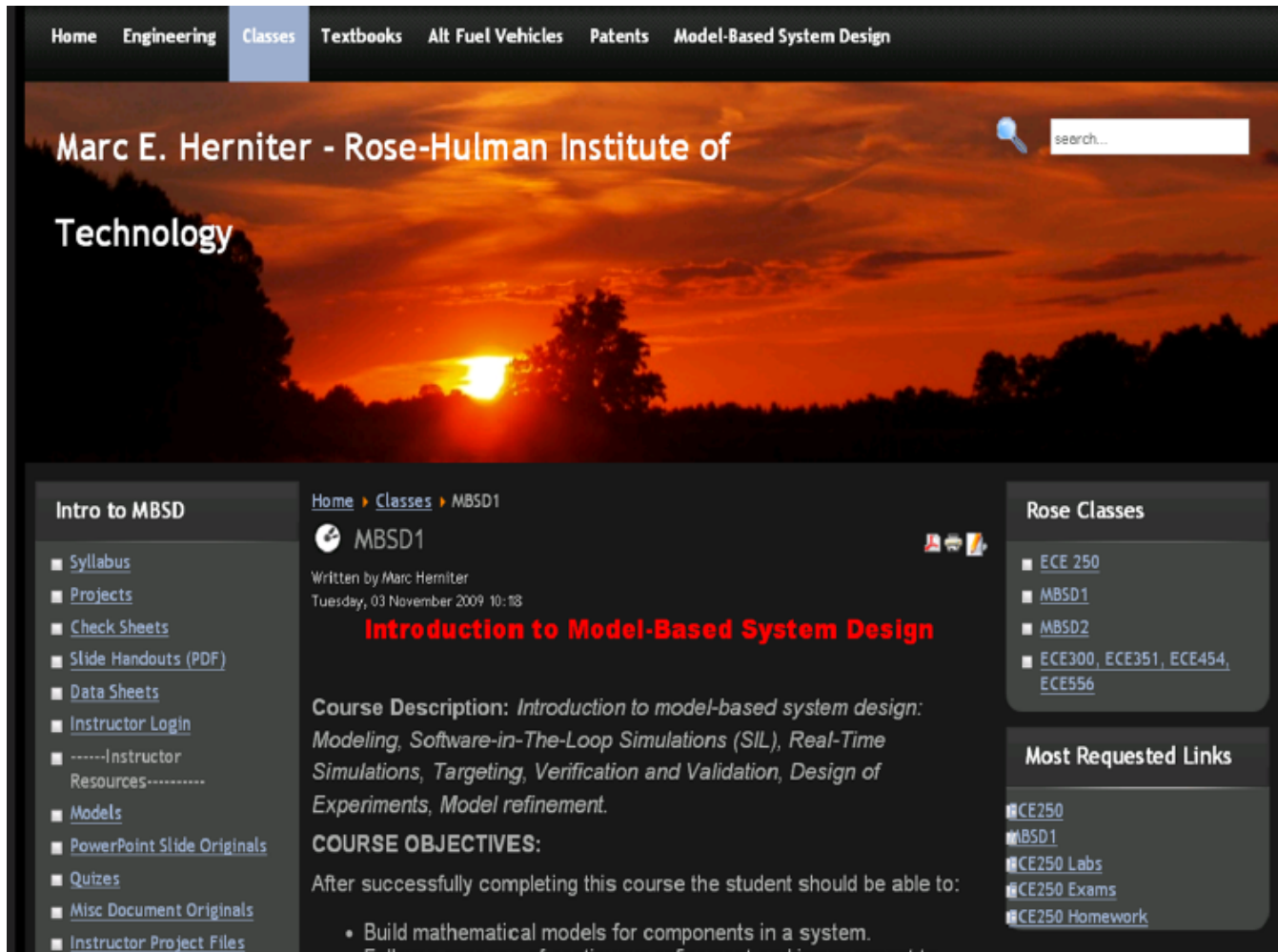


Trend: Focus on the system level in industry



Trend: Focus on the system level in industry

Response: Guidance and exposure to education



The screenshot shows a web page for a course titled "Introduction to Model-Based System Design" by Marc E. Herniter at Rose-Hulman Institute of Technology. The page features a navigation menu at the top with links to Home, Engineering, Classes, Textbooks, Alt Fuel Vehicles, Patents, and Model-Based System Design. The main content area includes a search bar, a breadcrumb trail (Home > Classes > MBSD1), and a list of course materials such as Syllabus, Projects, Check Sheets, Slide Handouts (PDF), Data Sheets, Instructor Login, Models, PowerPoint Slide Originals, Quizzes, Misc Document Originals, and Instructor Project Files. The course description and objectives are also visible, along with a list of Rose Classes and Most Requested Links.

Home Engineering **Classes** Textbooks Alt Fuel Vehicles Patents Model-Based System Design

Marc E. Herniter - Rose-Hulman Institute of Technology

search...

Home > Classes > MBSD1

MBSD1

Written by Marc Herniter
Tuesday, 03 November 2009 10:18

Introduction to Model-Based System Design

Course Description: *Introduction to model-based system design: Modeling, Software-in-The-Loop Simulations (SIL), Real-Time Simulations, Targeting, Verification and Validation, Design of Experiments, Model refinement.*

COURSE OBJECTIVES:

After successfully completing this course the student should be able to:

- Build mathematical models for components in a system.

Rose Classes

- [ECE 250](#)
- [MBSD1](#)
- [MBSD2](#)
- [ECE300, ECE351, ECE454, ECE556](#)

Most Requested Links

- [CE250](#)
- [MBSD1](#)
- [CE250 Labs](#)
- [CE250 Exams](#)
- [CE250 Homework](#)

Online and Technology Trends

- Computing resources in flux
- Hands-on with low-cost, open-source hardware
- Gamified on-line content
- MOOCs and Blended Learning
- Student competitions – big/small, live/virtual
- Systems thinking

What trends do **you** want to accelerate?

