



NAVAL
POSTGRADUATE
SCHOOL

Technology Support for Distributed Learning at NPS: A Story of System Evolution and SE Workforce Education

NDIA 15th Annual Systems Engineering Conference

Paper 14585

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SYSTEMS ENGINEERING
ESTABLISHED 2002



Read my paper!
As engineers, we communicate via information-dense media. The poor communication style of endless bullet-list Neanderthal grunts leads to a poor cognitive style counter to critical thinking and engineering reasoning.

Technology Support for Distributed Learning at NPS:

A Story of System Evolution

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Abstract

This paper describes the history of distributed learning (DL) at the Naval Postgraduate School (NPS), focusing on the technologies that were implemented and adapted for learner and instructor support. A description of distributed learning in North America in the latter half of the 20th century sets the context for the efforts at NPS. The challenges and successes of early adopters are described. Available technologies and how they were adapted for educational purposes are described. The co-evolution of learning strategies and supporting technologies is discussed. Champions and opponents of DL are discussed, along with how they identified or aligned themselves. The current state of DL technology and institutional support is provided. Finally, the paper presents several continuing and emerging challenges that appear to limit the growth of DL technology along with an assessment of several mechanisms which offer potential solutions.





In the Beginning

1852



1873



SOCIETY TO ENCOURAGE
STUDIES AT HOME: FOUNDED
1873 BY ANNA ELIOT TICKNOR

1890



1892





NAVAL
POSTGRADUATE
SCHOOL

20th Century



THE UNIVERSITY
of
WISCONSIN



1920's

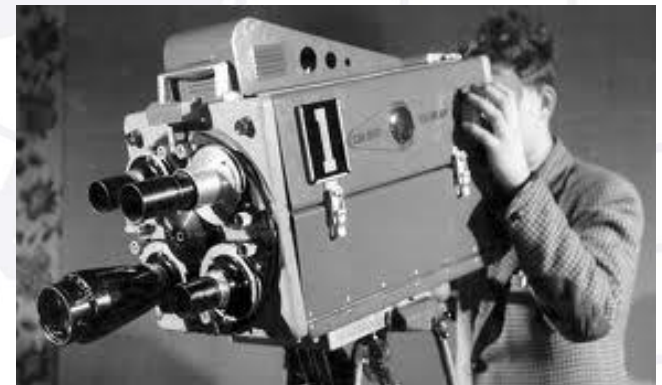


THE UNIVERSITY
OF IOWA

1934



1964



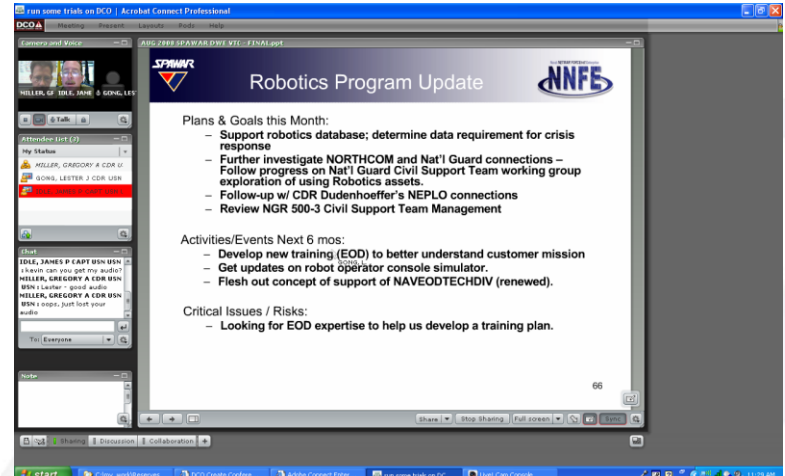




ooVoo



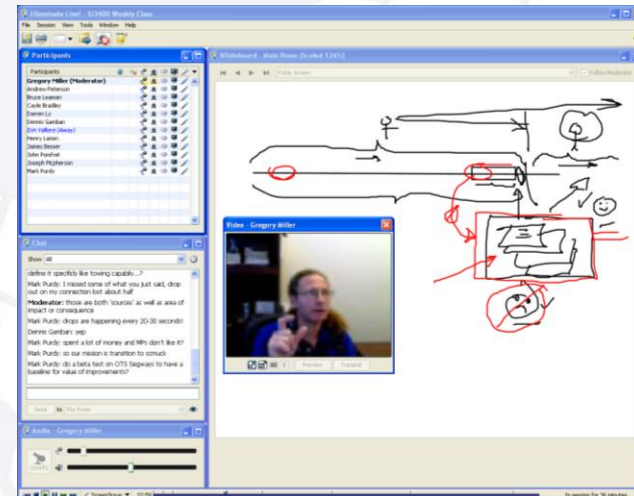
Adobe Connect



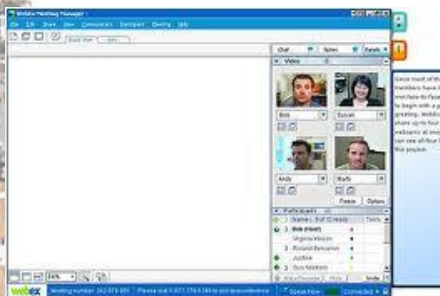
Skype



Elluminate

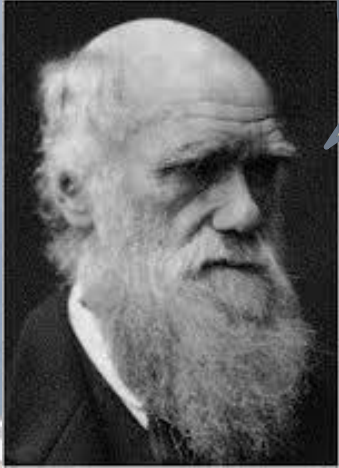


WebEx



Effects of Technology on Education

Google
it!



Alexis Rockman



Criticisms of DL – Old & New

New technology . . . creates a cognitive dissonance, an emotional mismatch, between the potential of the new and the security of the old (*The Nature of Technology*, 2009).



Brian Arthur

Correspondence study . . . frills – no more appropriate to higher education than football or fraternities (1918)



Thorstein Veblen

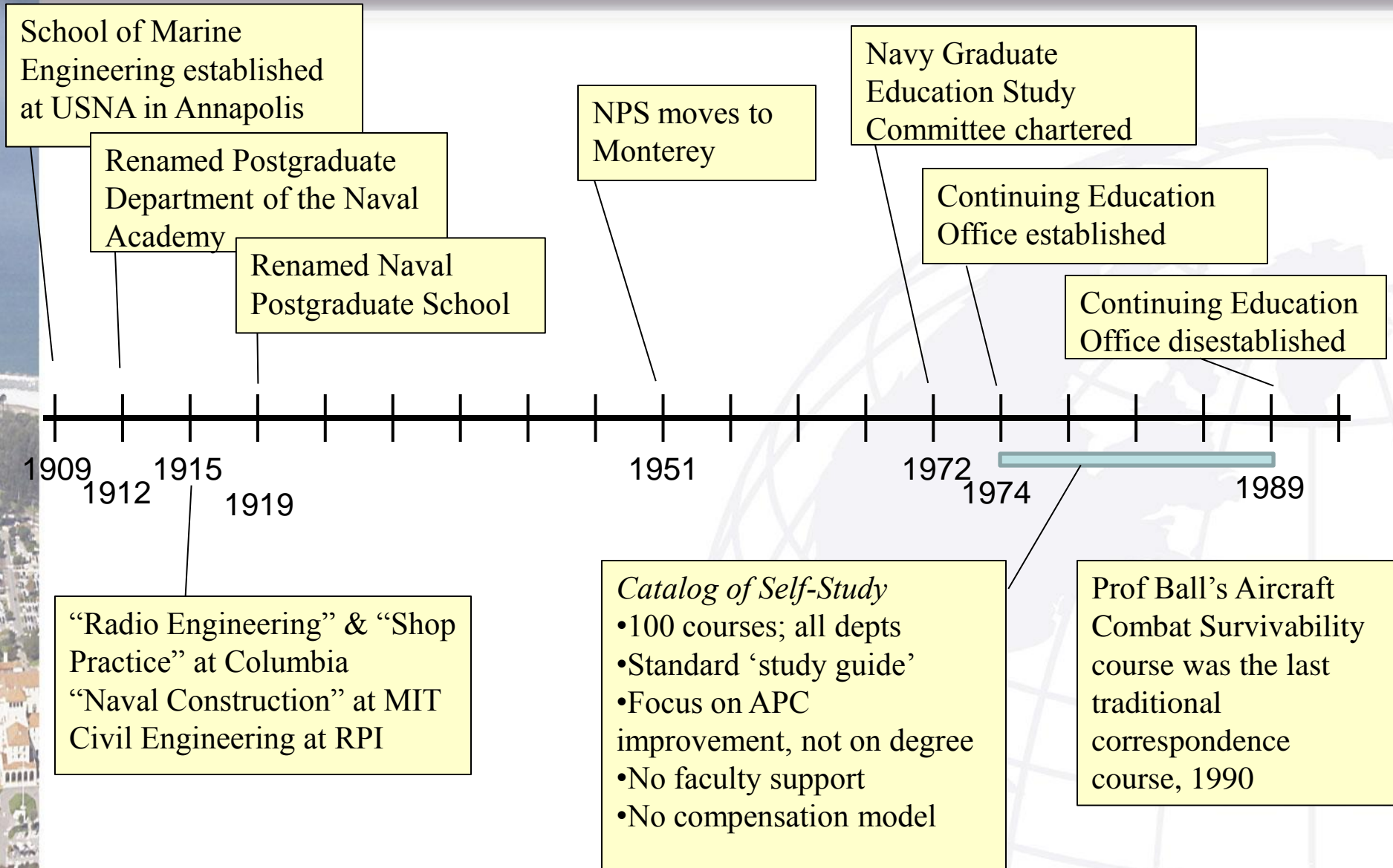


Modern Luddites?



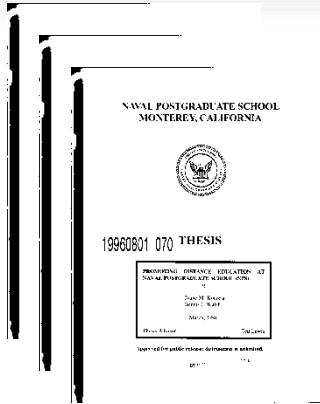


DL at NPS – The Beginnings





Introduction of VTC



1992, 94, 96



Professor Emeritus
Robert Ball



First course (1994): "Aircraft
Combat Survivability" with 18
NAVAIR employees; MS in
Aeronautical Engineering

Programs added in 1996:
MS in Software Engineering
MS in Electrical Engineering
Added in 1997:
DAU Equivalency courses
Officially in Course Catalog
1998



Issues:

Emerging VTC standards
Scheduling conflicts
No faculty support
No compensation model
No campus-wide strategy . . .

MS in Aero Eng stopped in 1999



. . . But, new MCU added and
two more classrooms converted.
And, MS in Program
Management added in 1998

2000



Under Secretary of the
Navy Jerry Hultin

NPS Systems Management Department, join
the Education Consortium for Product
Development Leadership in the 21st Century!

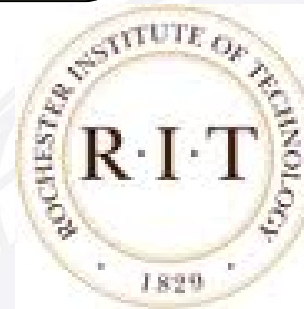


David Lamm



Wally Owen

- The challenges to be overcome include:
- 1) the interdisciplinary nature of the degree itself
 - 2) organizational resistance to change
 - 3) establishment of administrative and technical support for students & faculty
 - 4) establishment of procedures for financial management





Resistance and Support

CAVE-man:
Colleague
Against
Virtually
Everything



Dick Elster



Tracy Hammond



H.263 standard – 1996, and others



Overcoming Obstacles



FY2001



SPAWAR



“ . . . the first program to actually employ a executive style delivery mode (back-to-back classes on the same day), first with a standard faculty compensation model, first with a standard set tuition price”

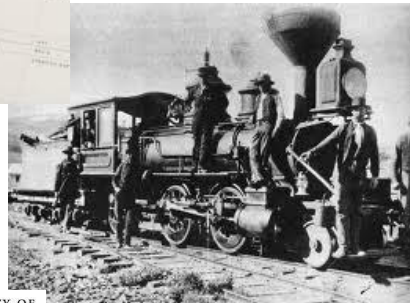


Liz Burge

. . . having to navigate the squalls and tempests of innovation, scaling up institutional operations to meet student demand and access criteria, enduring critiques from traditionalist colleagues.



Parallels with Other “Co-Evolutions”



James Watt steam engine
~1780



Reciprocating engine
probably Daniel Davis
Early 1840's



THE UNIVERSITY
of CHICAGO
GRAHAM SCHOOL
of CONTINUING
LIBERAL AND
PROFESSIONAL
STUDIES

Degrees Non-Degree Credit Certificates Noncredit **Online Learning**

Online Learning

In April 2012, the Graham School launches a new learning option—online certificate programs. Our online programs feature the same curriculum and instructors as our face-to-face programs, but in a distance learning format designed to serve busy professionals who find it difficult to travel to Chicago to attend the program. The Graham School's programs feature the quality and rigor you expect from the University of Chicago. Like all programs at the University, our programs, including our online programs, are designed to offer

Mc
Ene
Las



Maturation & Support



2000



2008



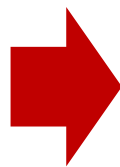
2008



2006



Blackboard



2009

NAVAL POSTGRADUATE SCHOOL

DISTANCE LEARNING
HIGH QUALITY EDUCATION BY NPS, ANYWHERE ANYTIME!

DL Home DL Programs Students Applicants

DL Home

Welcome to Distance Learning at the Naval Postgraduate School

NPS is dedicated to providing relevant, high quality education, anytime and anywhere. A variety of delivery methods are utilized to expand learning beyond the traditional classroom.

<p>Search DL Programs</p> <p>Comprehensive List of NPS DL Programs.</p> <p>Certificates Masters PhDs</p> <p>Find a Program</p>	<p>Apply Online</p> <p>Begin Application Process.</p> <p>Application Form Contact Information Requirements</p> <p>Apply Now</p>	<p>DL Student Handbook</p> <p>For DL Students and Prospective Students.</p> <p>Academics Technology Getting Started</p> <p>Read Handbook (pdf)</p>
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Degree Program Students by Type of Enrollment [NPS Factbook, 2010]

Year	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Full Time Resident	1283	1279	1269	1244	1314	1481	1560	1732	1739	1566	1489	1557
Distance Learning	95	111	180	221	247	322	523	501	847	719	707	819
Total	1378	1390	1449	1465	1561	1803	2083	2233	2586	2285	2196	2376

Trends in Technology Support [NPS Factbook, 2010]

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Number of LMS Courses	138	252	323	408	467	578	636	706	1124	1433
Hours of Streaming Video				2890	3467	4160	5233	7040	11677	12717
Number of Web-based Lectures							420	2044	3702	4733

<http://cyclon.uc.nps.edu/studentMap/>



Challenges & Limits



Linden Lab



OHIO
UNIVERSITY



East Carolina
UNIVERSITY



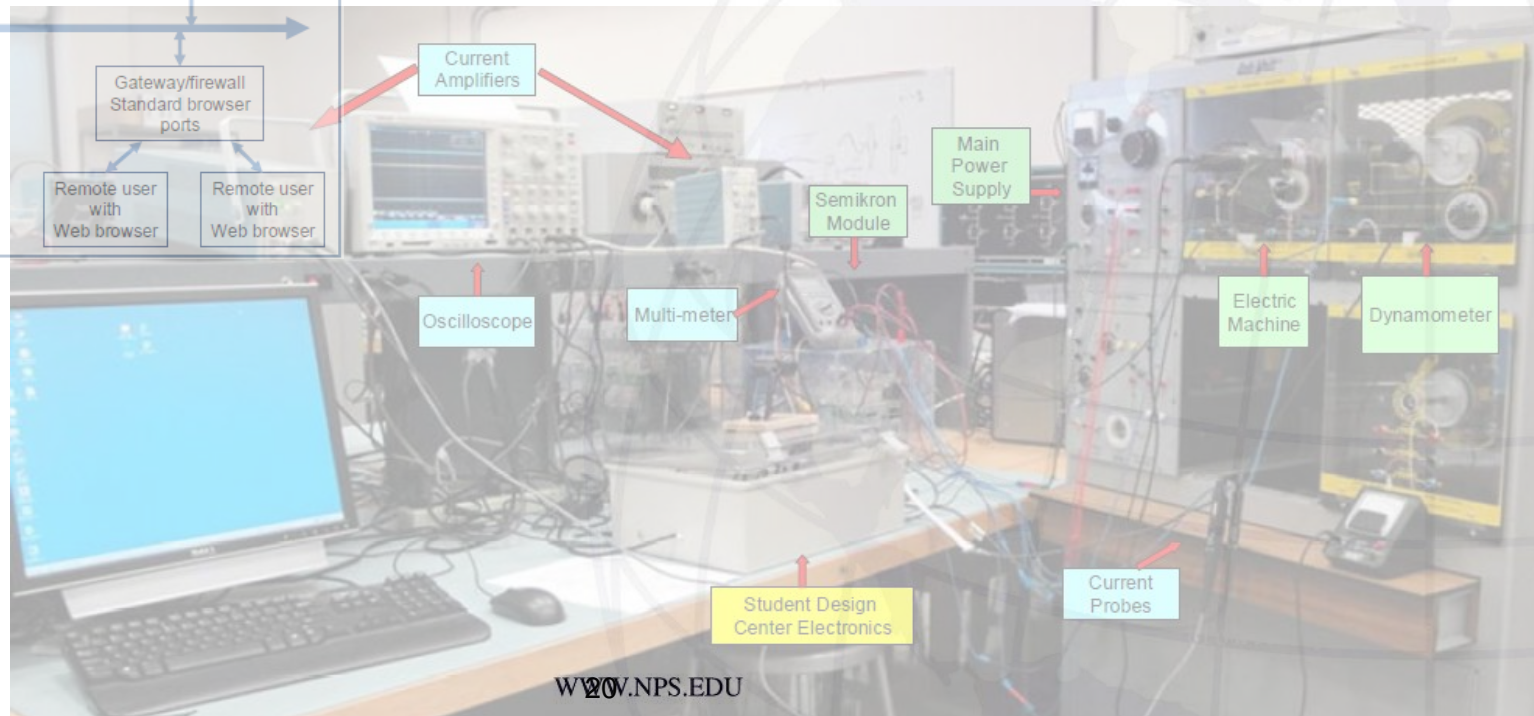
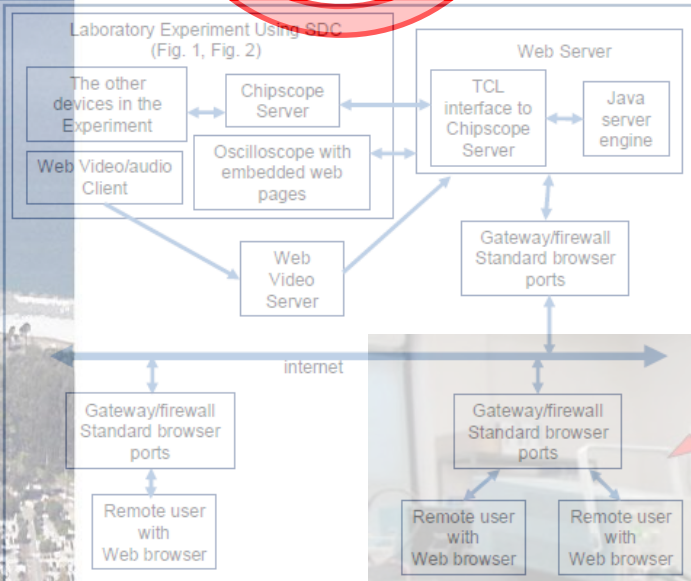
Challenges & Limits



Giovanna Oriti



Alexander Julian





Challenges & Limits

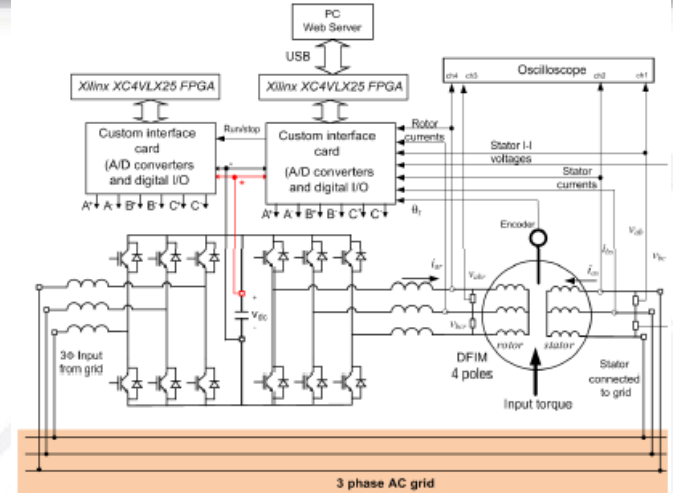
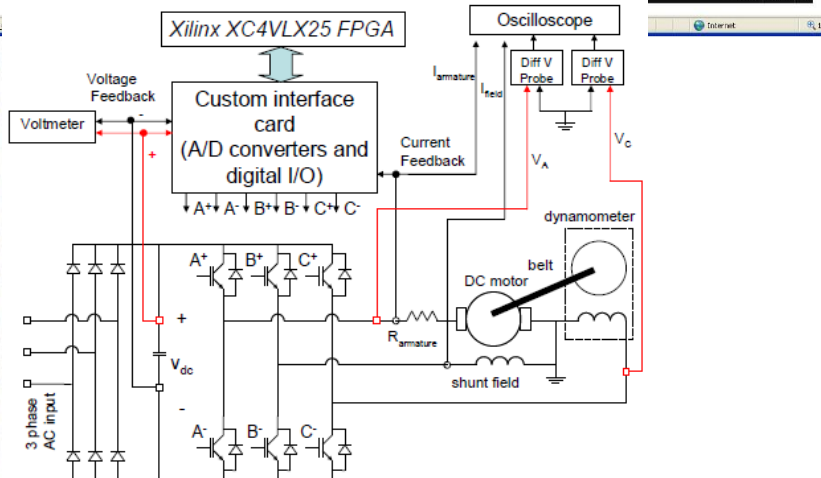
Remote web interface for the DC motor laboratory example: control window

Instructions: Please follow the steps below when completing the lab exercise. For more information on using this website, please go to the 'lab help' tab.

1. Program the FPGA by clicking on the appropriate button on the web interface.
2. Check that the DC bus voltage has been set to 150 V.
3. Select one of the two options "IR Comp On" or "IR Comp Off".
4. Turn on the power converter (run motor).
5. Perform the measurements as described in section 4 of the 'lab overview'. Please push the appropriate speed and load button for each measurement.
6. Stop the motor after completing the data recording.

Lab Control Interface: Use the display below to program the FPGA and control the motor.

WebCam: Watch the webcam below to see the equipment updating live.



Remote web interface for the doubly-fed induction machine

DOUBLY-FED INDUCTION MACHINE DRIVE LABORATORY

LIVE WEBCAM OF LAB SETUP

OSCILLOSCOPE

DC Bus Voltage: 160 volts

DFIM Power: ON

DFIM Speed: 1890 rpm

Change DFIM Speed: 1890 rpm

Change Lead: 0%

Oscilloscope Controls (Opens in a new window)

“How can technology be used or adapted to improve interaction and student engagement, to achieve the course goals?”



George Basalla's hammers

. . . only that which supports the pedagogy survives and becomes widely adopted. That becomes the primary driver. Like any other domain, we see all aspects of technology evolution in the DL domain. It is . . . about the adoption of the most-fit set of technology for its restricted environment of education populated by learners, educators and administrators.

- Read my paper!



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