IRA A. FULTON SCHOOLS OF engineering

ARIZONA STATE UNIVERSITY

Online delivery of an undergraduate engineering program

School of Electrical, Computer and Energy Engineering

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Program Chair, online

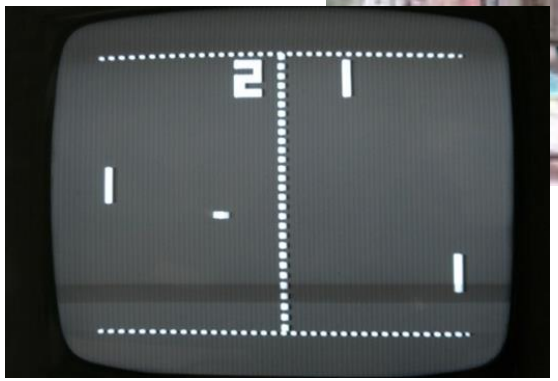
Disruptive change

ODYSSEY
THE ELECTRONIC GAME CENTER FROM
Magnavox

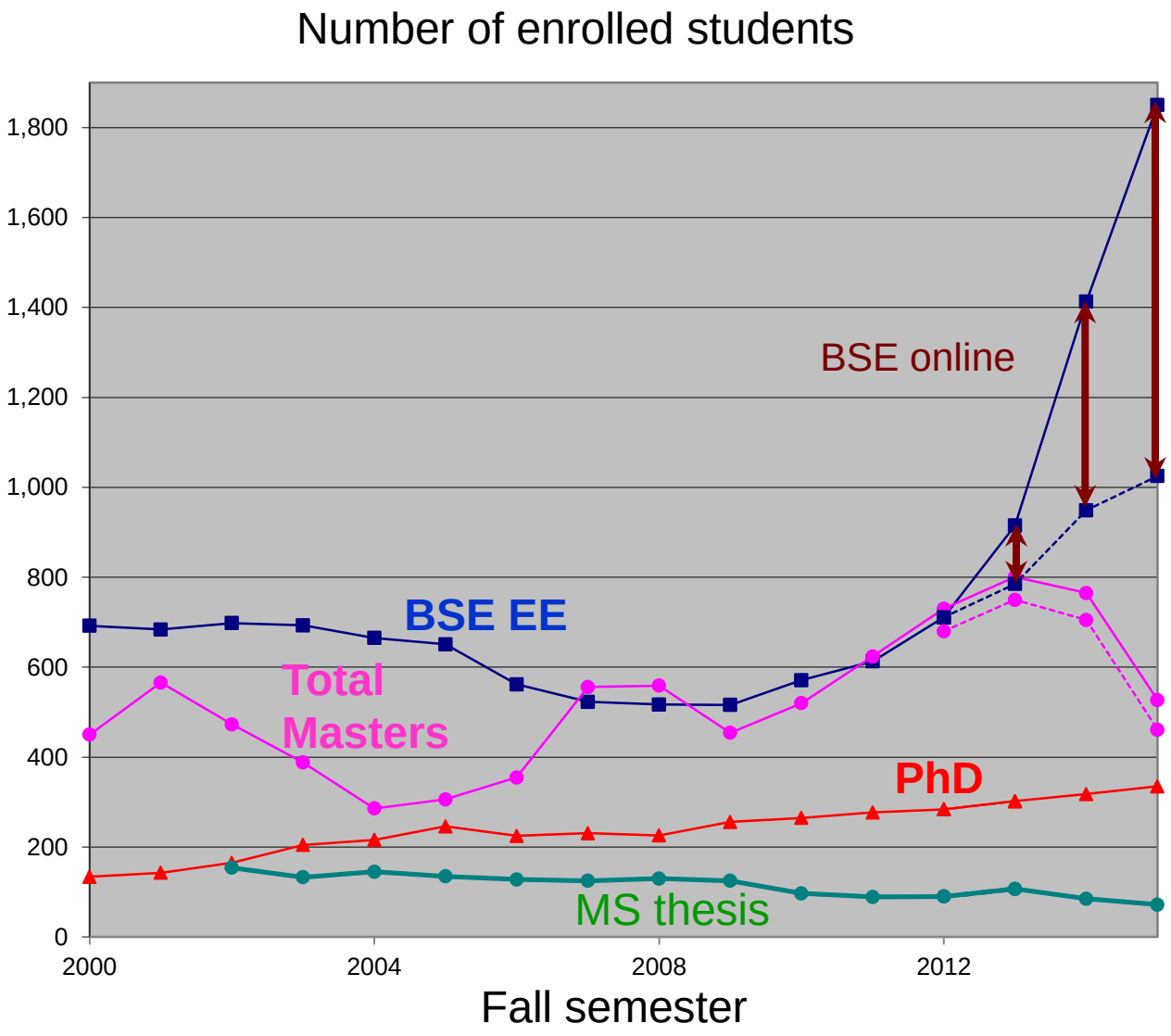
BLOCKBUSTER

Kodak

radioshack



ECEE School Plans - Academics



- BSE retention: 88%
  - FTFT Freshmen (persistence at ASU)
- BSE 33% minority
- BSE 50% have >= 12hrs transfer credit
- BSE online Fall 2013
- Investment in Ph.D. (>4.5 per faculty)

Fall 2015

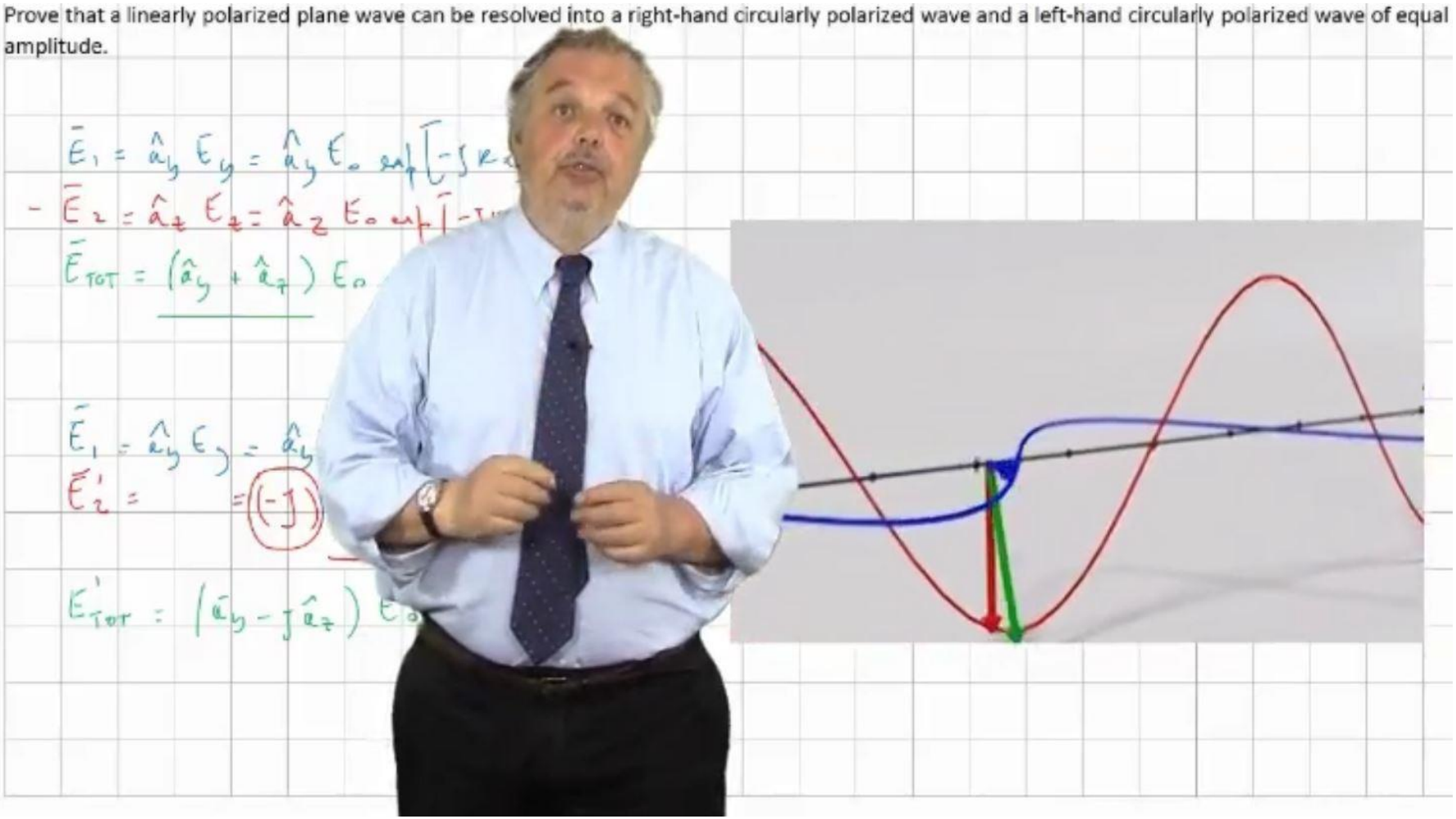
- ~ 330 PhD
- ~ 700 MS+MSE
- ~ 1800 BSE (~800 online)
- ~67 faculty

2014-15 Student profile

BS EE program AY 2014-15	online	face-to-face	
Average age	32	22	
Selectivity: admitted/applied	31%	67%	more unqualified online applicants
Yield: enrolled/admitted	63%	52%	online more likely to enroll
Veterans/active military	**35%**	7%	>200 enrolled online
Female	11%	11%	
UR Minority	19%	26%	
AZ resident	15%	75%	
International	<1%	15%	
Starbucks	<1%	??%	
Enrollment trend	100	800	Fall 2013
	200	800	Spring 2014
	400	900	Fall 2014
	800	1000	Fall 2015

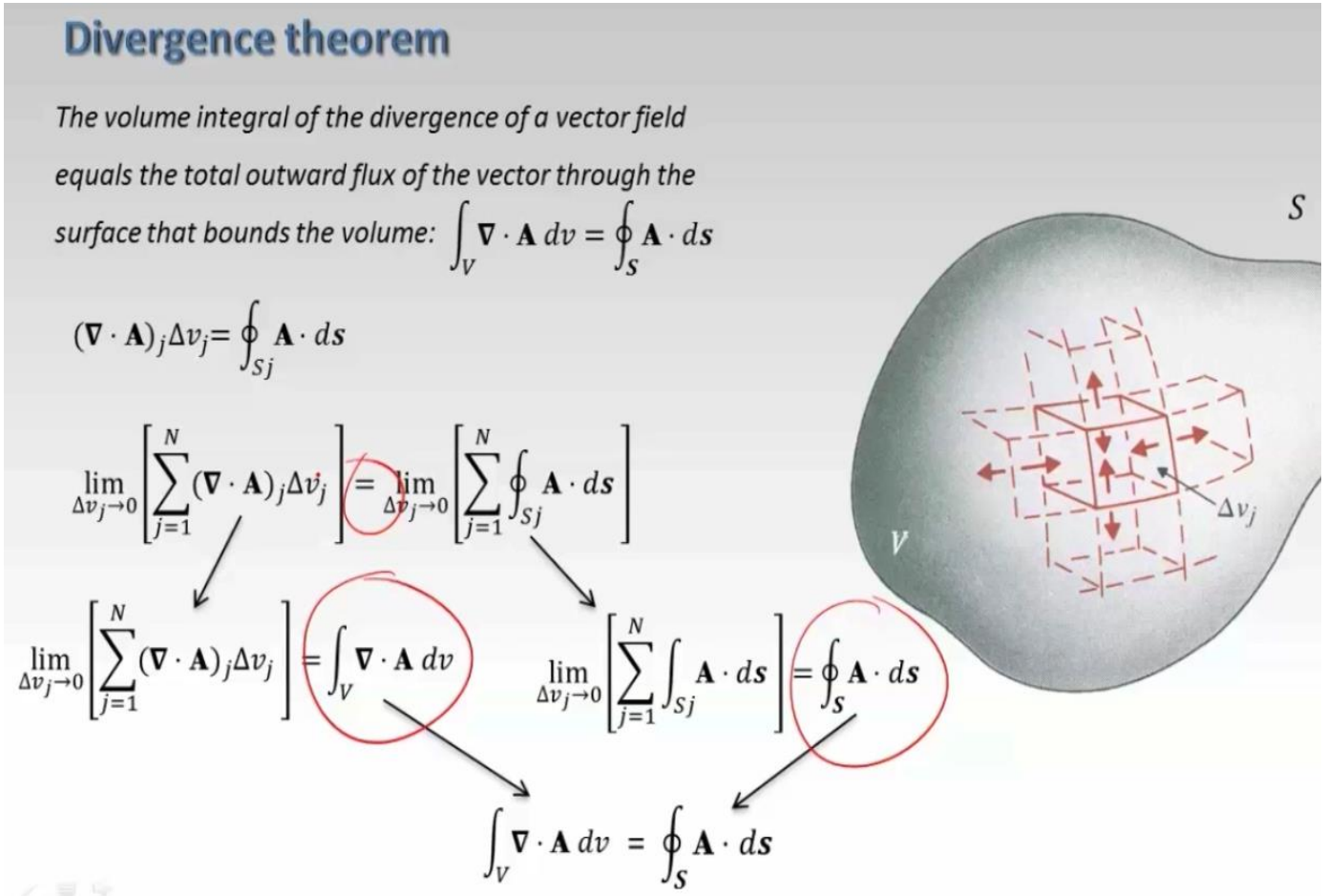
One online approach

- NOT a capture of a traditional lecture, high production quality
- Many engineers seek perfection given tools: video editing … watch yourself



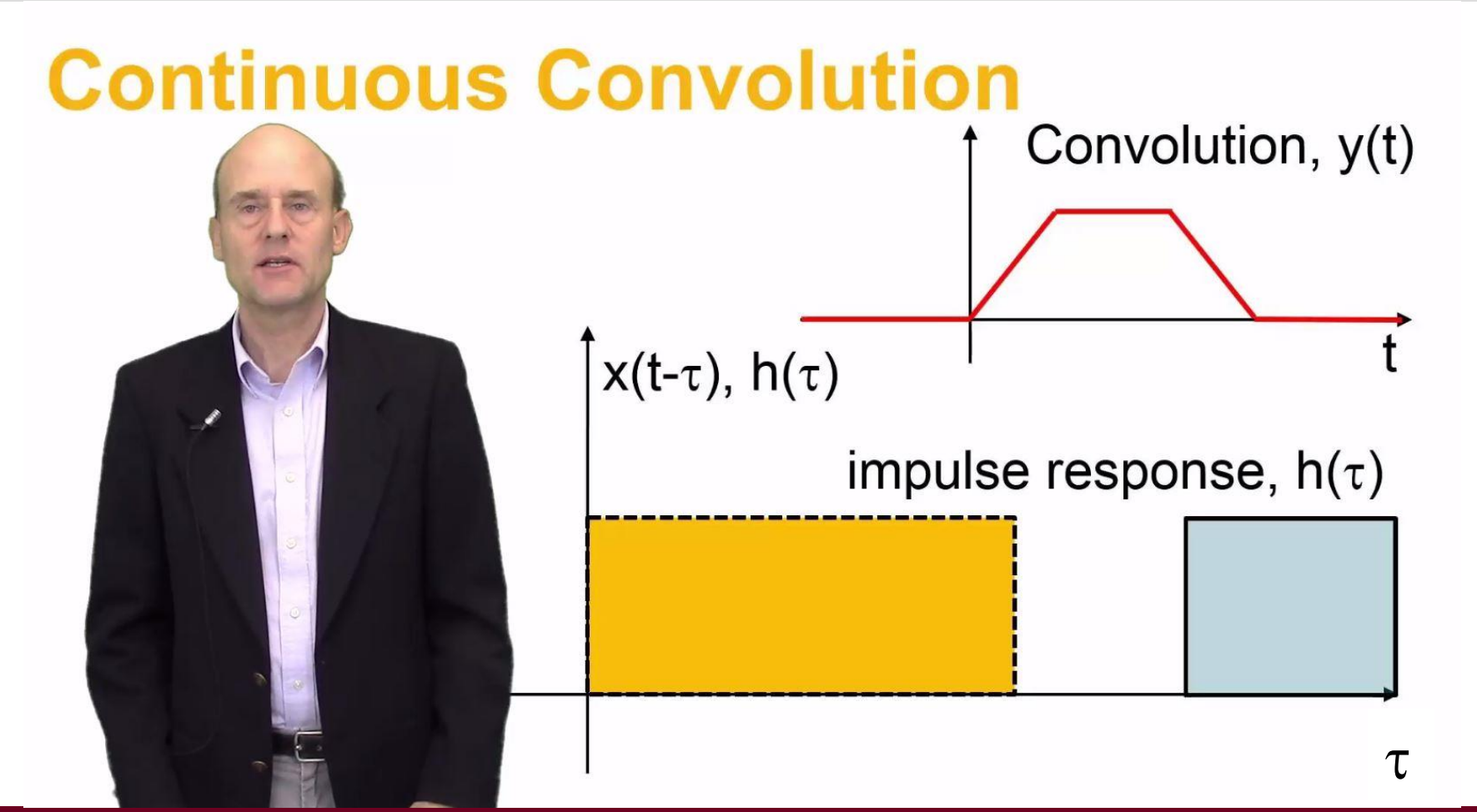
One online approach

- Produce, debug, produce, pilot-deliver, assess, evaluate, debug, repeat …
- Instructional designers are key: how do students want to learn?



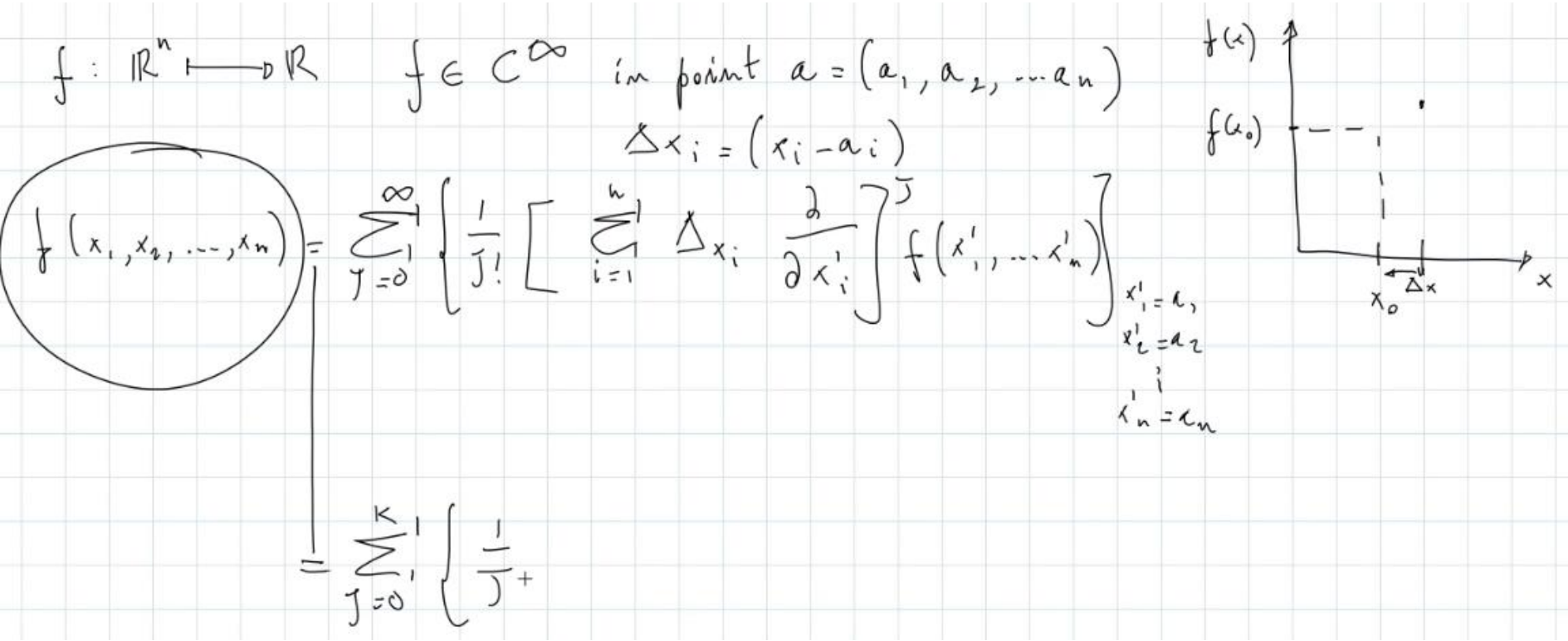
One online approach

- Pedagogical innovation: Short videos on a single topic, include animations, integrate self assessments, pass quiz before progressing
- Extra material, unlimited time for examples, link in prerequisite material



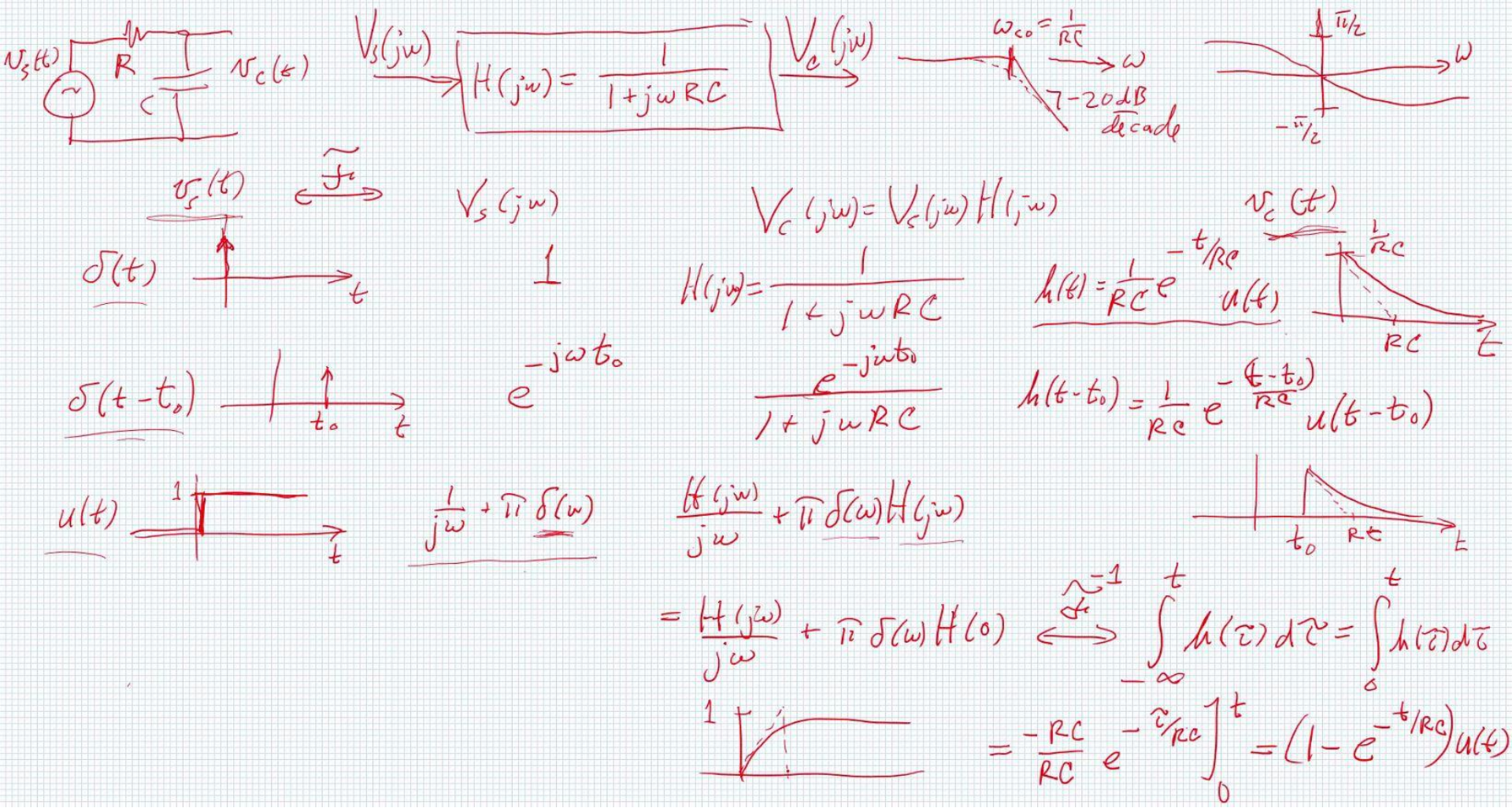
One online approach

- Office hours via Skype with pdf capture for participants
- Popular with on campus students and online (students Skype in anywhere)
- Popular with some faculty (can do it from anywhere with tablet and stylus)
- Face to face students are requesting this
- Flipped classroom leverages content developed



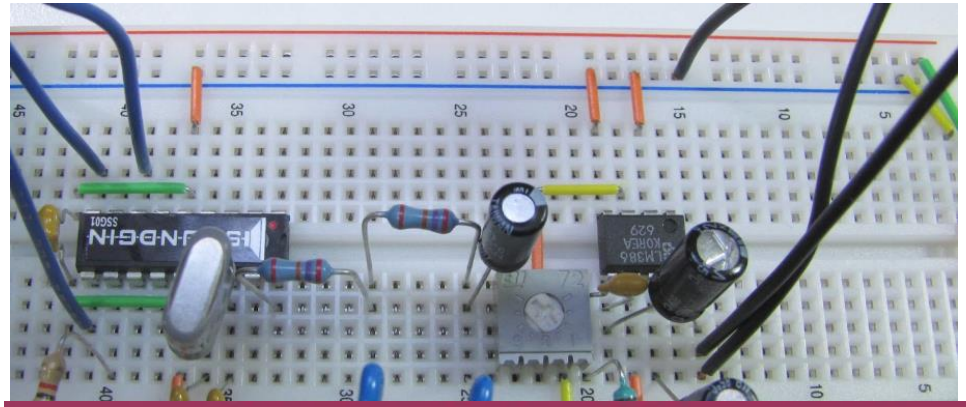
One online approach

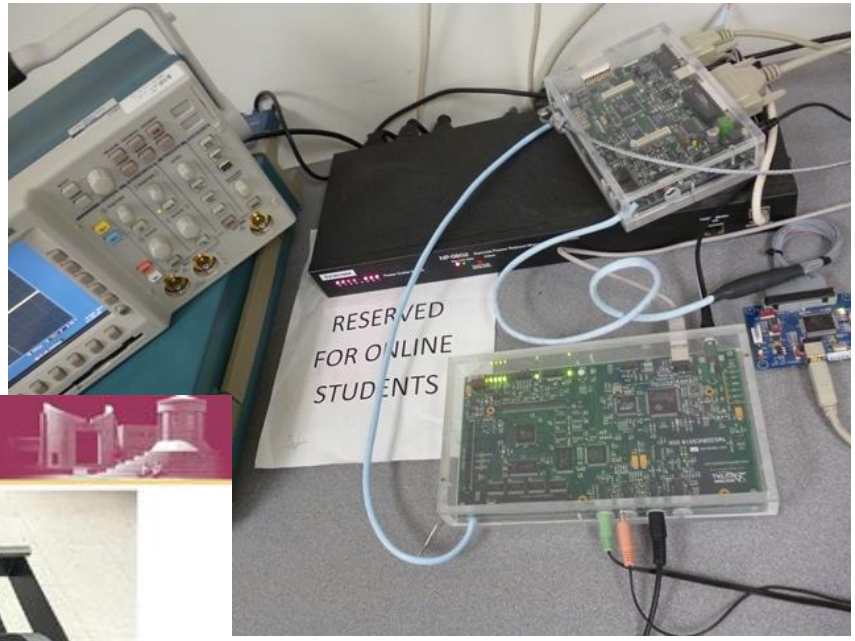
- Not all faculty want (or should) do this (yet).
- Share videos, examples, content among courses (RC filter in 4 courses)



One online approach

- Labs: hardware kits, simulations, web controlled experiments





Do licenses allow remote access?

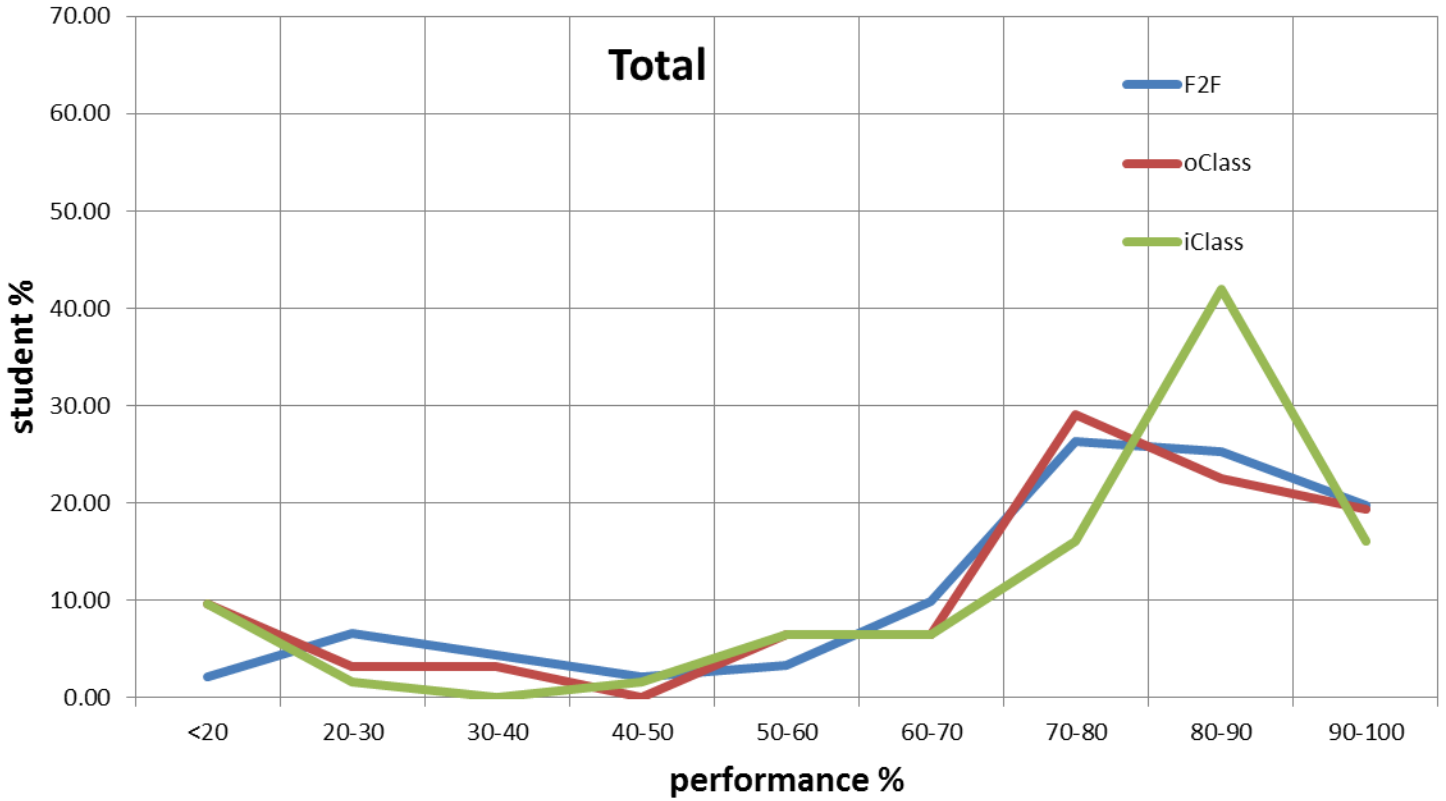
Matlab usually allows

Cadence usually does not

International embargoes

International export control

Student Performance



Histogram of student performance in course grade

Why Online Engineering?

- **I work full time as an electrical designer for an engineering firm and am taking the plunge to get my degree in Electrical Engineering. My wife and I thought I was the only person crazy enough to tackle this while working full-time with two kids, but after reading other introductions I am glad to see there are many other crazy people out there!**

  - James R.

- **I'm working towards an electrical engineering degree in the hopes that when my second enlistment is up we will have a stable home without worries when it comes to finding work. Being a single mom in the military is tough . . .**

  – Alycia B.

Backup Slides

Stop here

Back up slides about ABET, Starbucks, program details, ASU numbers.

ABET and online programs

- Disclaimer: I do not represent ABET.
- From the ABET web page http://www.abet.org/online-programs/

What is an Online Program?

Many academic programs in higher education have at least some content offered online, including individual courses, homework assignments, and class research projects. What constitutes an "online" program is not always well-defined. In addition, the percentage of online content for any academic program changes frequently.

The vast majority of ABET-accredited programs are offered mostly on-site.

The following ABET-accredited programs are offered in a 100-percent online format. This list is updated annually in October.

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Air Force Institute of Technology
Wright-Patterson Air Force Base, Ohio, U.S.
Systems Engineering (MS)

Arizona State University
Tempe, Arizona, U.S.
Electrical Engineering (BSE)

Capella University
Minneapolis, Minnesota, U.S.
Information Technology (BS)

Oakland University
Rochester, Michigan, U.S.
Occupational Safety and Health (BS)

Regis University
Denver, Colorado, U.S.
Computer Information Systems (BS)
Computer Networking (BS)
Computer Science (CPS) (BS)

Thomas Edison State College
Trenton, New Jersey, U.S.
Nuclear Energy Engineering Technology (BS)

Trinidad State Junior College
Trinidad, Colorado, U.S.
Occupational Safety and Health Technology (AAS)

University of Southern Mississippi
Hattiesburg, Mississippi, U.S.
Construction Engineering Technology (BS)

Walden University
Minneapolis, Minnesota, U.S.
Information Technology (BS)

Online Program Accreditation

ABET evaluates programs that use a variety of delivery methods: on-site instruction, online instruction, and those having components of both methods. The programs are evaluated against the same standards regardless of delivery method.

member societies representing many disciplines.

Learn more about ABET's 33 member societies.

In fall 2013

ABET accredited 100% online programs

- ABET considers several programs to be 100% online: www.abet.org/online
- As of November 15, 2015 - 19 programs at 15 institutions:

- Applied Science Accrediting Commission
  - 1 MS program, 2 BS programs, 1 AAS program (incl. occupational, health and fire safety)

- Engineering Technology Accrediting Commission
  - 5 BS programs (electrical, nuclear and construction technology)

- Computing Accrediting Commission
  - 6 BS programs (information technology/systems, computer science/networks)

- Engineering Accrediting Commission
  - 2 MS Engineering programs (AFIT and JHU Systems Engineering)
  - 2 BS Engineering programs (ASU and Stony Brook Electrical Engineering)

- Other accredited BS Electrical Eng. programs that are “mostly” online
  - U North Dakota (labs on campus)
  - Clemson U (EE courses, summer)
  - Morgan State U (2+2)
  - Others under development

Separate program or same program

- Separate program approach requires separate accreditation.
  - Cannot be accredited until the first student graduates (but is then can be retroactive).
  - Initial review is likely to be intense

- Same program approach (every “path” must meet accreditation criteria)
  - Admissions requirements and processes, transfer evaluation, advising, tracking progress
  - Curriculum, prerequisites, electives, faculty qualifications, support departments
  - Assessment (collect separately), continuous improvement, constituent buy-in
  - ** Laboratory experiences, teamwork, capstone design, placement services

- Risk of same program: If online path fails, original program fails with it
- Risk of separate program: Potential low enrollment prior to accreditation

Disruptive change

ASU, Starbucks to offer full tuition coverage for all eligible employees

Posted: April 06, 2015

Arizona State University and Starbucks announced April 6 that the Starbucks College Achievement Plan, first introduced in June 2014,

ASU President Michael Crow (left) speaks with Starbucks CEO Howard Schultz and ABC news correspondent Rebecca Jarvis about the expanded ASU-Starbucks tuition partnership at the ASU+GSV Summit, April 7, at The Phoenician Resort in Scottsdale, Arizona.
Photo by: Andy Del Isle/ASU

Now:
Full tuition
4 years
Includes part-time employees!
49 online undergraduate programs
2000 enrolled

By 2025:
Potential for 25,000 students
Starbucks to invest up to $250M

One online approach

- Exam authentication
  - Several vendors, Who pays for service?
- Different student profile
  - few first-time freshmen (some special needs students)
  - few full-time (most enroll in 2 courses / semester, 7.5 week format)
  - mostly working (know how to network)
- Advising challenges
  - Transfer credit
  - Military deployments
  - Old courses, take again?
- Motivated, mature students!
  - Allows SOME scaling (currently 2X number of students)
  - Faculty-student interaction cannot be neglected (not everyone should teach this way)
  - Not shy about complaining (but some try to enroll in too many courses)
- Suggestions for success:
  - Let some one else do the first program if possible (history?)
  - Select program carefully (student demand, capacity to deliver, open mindedness)
  - Select and reward a few faculty VERY carefully (these few will help recruit others)
  - Roll out deliberately (when do you want your president to announce it?)

One online approach

- ASU offers entire BS EE program online (labs, electives, gen. ed., …)
  - Gen ed, science, math done first, engineering lower division next, upper division labs last
- Institution negotiates agreements with other states (each one is different!)
- Institution provides platform, instructional support infrastructure, experts
  - Instructional designers are key, must be a team with faculty, technology matters
- ABET program accreditation achieved: same program, different delivery
  - ASU EE currently the only ABET accredited BS engineering program offered 100% online
- Appropriate faculty incentives (cash, teaching release, handshake)

- Few online first-time freshmen, many have 60 xfer hours, special needs
- Almost all working, many veterans, active military, most part-time
- Advising challenges (xfer credit, military deployment, “old” courses …)
- Motivated, mature students allows SOME scaling, retention?
- Out-of-state tuition discounted

- Labs: hardware kits, simulations, web controlled experiments, CAD
- Office hours via Skype very popular (for on campus too), forums/chat rooms
- Proctor-U: exam authentication

ASU Numbers

- ASU People (Fall 2015)
  - >90,000 students (>50,000 in Tempe, >20,000 online)
    - >17,000 graduate students, ~20%
    - 60% documented AZ residents, “in state” tuition: ~$10k/AY
    - 78% full time
  - >13,000 faculty and staff
    - >2700 faculty
  - >1,000,000 Student credit hours
- ASU Programs
  - > 150 undergraduate majors >14,000 Bachelors degrees awarded/yr
  - AZ Freshman, 42% first-generation college students, 36.6% minority
  - > 75 doctoral programs
  - >$2 billion revenue, ~$200M state support
- ASU Research Goal is $700M/yr by 2020
  - Current research is ~$400M/yr

Fulton Schools' Programs

- Degree Programs
  - 10 ABET accredited engineering programs
  - ~20 programs
- Fulton Enrollment
  - 14,500 undergraduates Fall 2015
  - 4000 graduate students Fall 2015
- Fulton Faculty
  - 275 Tenured or tenure-track Fall 2015
- Fulton Research
  - $89 M expenditures FY 2015
  - $89 M awards FY 2015
- Engineering Program Ranking
  - Top 50 in USNews and World Report (43 Grad)

Timeline

1969	Stanford broadcasts courses to industry students
2002	MIT open courseware project publishes first course
2010	ASU-online launches first six degree programs
2011	Sebastian Thrun and Peter Norvig offer AI MOOC Andrew Ng offers machine learning MOOC
2012	Thrun founds Udacity, Ng founds Coursera MIT and Harvard launch edX New York Times declares 2012 “the year of the MOOC”
2013	ASU launches first 100% online BSE program accredited by EAC of ABET