



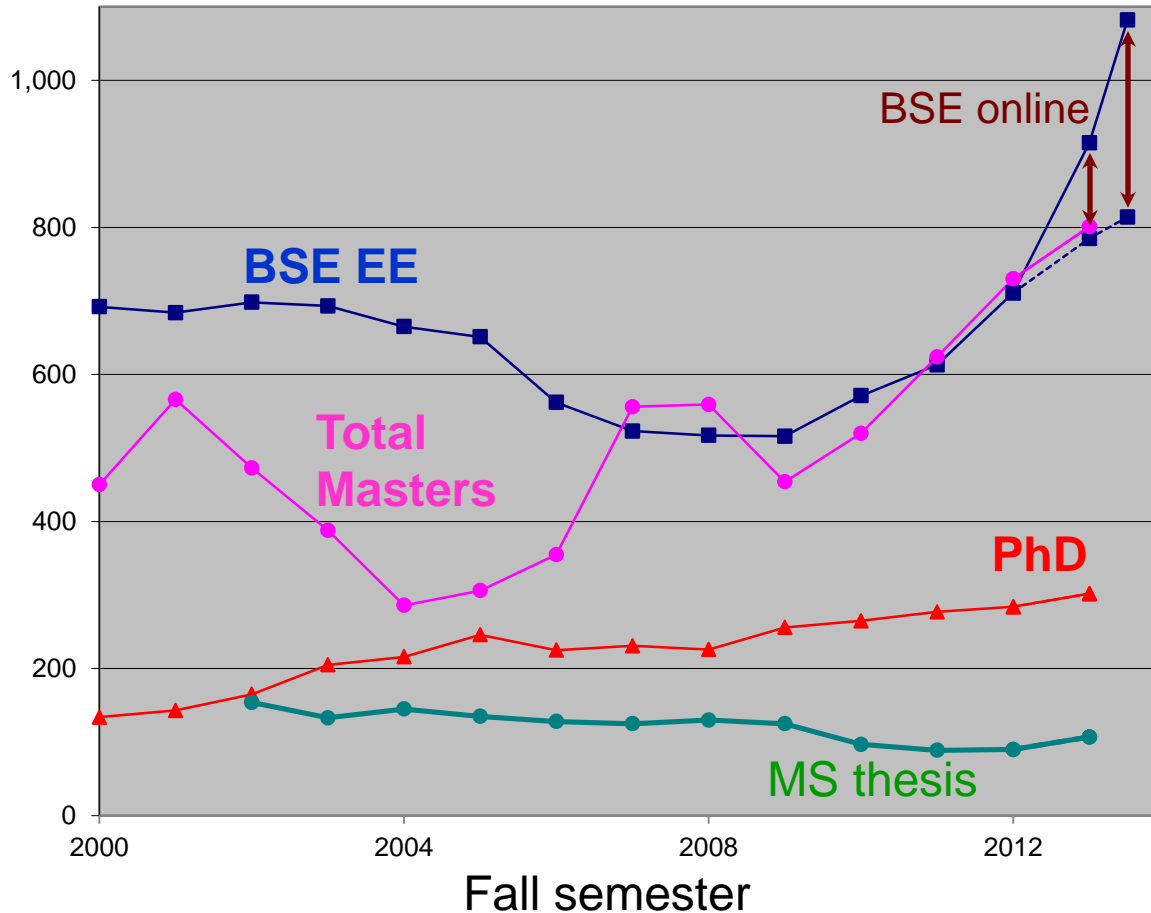
# School of Electrical, Computer and Energy Engineering

Arizona State University  
Tempe

Stephen M. Phillips, Ph.D., P.E.  
Professor of Electrical Engineering  
Director of the School



Number of enrolled students



BSE retention: 89%  
 FTFT Freshmen  
 (persistence at ASU)

BSE 33% minority  
 BSE 50% have  $\geq$   
 12hrs transfer credit

On-line BSE Fall 2013

Investment in Ph.D.  
 ( $>4.5$  per faculty)

~ 300 PhD

~ 800 MS+MSE  
 (~100 online)

~ 1100 BSE  
 ( $>250$  online)

~65 faculty

- Institution negotiates agreements with other states
  - Ability to offer degrees to students residing in other states...
  - Varies by state!
  - Varies by discipline!
  - ABET is an advantage for engineering (same in every state)
- Institution provides platform, instructional support infrastructure
  - Delivery platform (migration!)
  - Instructional design support staff (design and produce a class)
  - Production infrastructure (studios, offsite, homebrew)
  - Production staff (must be knowledgeable and able to work with faculty)
- Complete path to graduation available
  - General Ed electives developed by others
  - Most technical electives available
  - All labs available
- ABET accreditation achieved
  - Considered same program with different delivery
  - Details shortly ....
- Appropriate faculty incentives
  - Cash
  - Teaching release
  - Handshake

- Many engineers seek **perfection** given tools: video editing ... watch yourself
- Produce, debug, produce, pilot-deliver, debug, produce, deliver
- Instructional designers are key:
  - modules, on-demand examples, prerequisite topics, quizzes, exams

## Divergence theorem

The volume integral of the divergence of a vector field equals the total outward flux of the vector through the surface that bounds the volume:  $\int_V \nabla \cdot \mathbf{A} \, dv = \oint_S \mathbf{A} \cdot d\mathbf{s}$

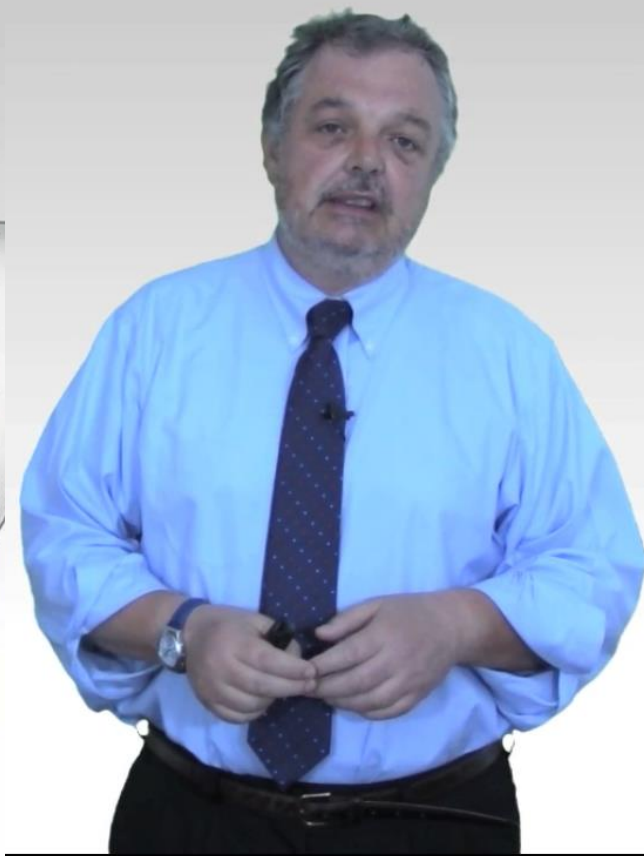
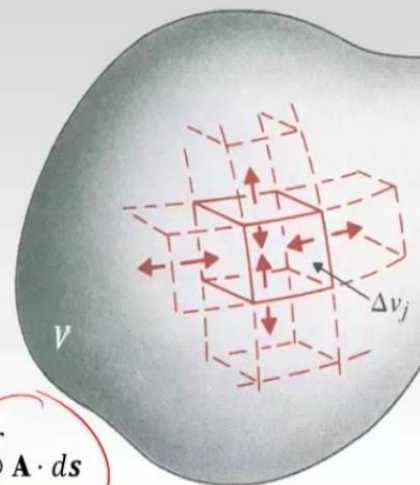
$$(\nabla \cdot \mathbf{A})_j \Delta v_j = \oint_{S_j} \mathbf{A} \cdot d\mathbf{s}$$

$$\lim_{\Delta v_j \rightarrow 0} \left[ \sum_{j=1}^N (\nabla \cdot \mathbf{A})_j \Delta v_j \right] = \lim_{\Delta v_j \rightarrow 0} \left[ \sum_{j=1}^N \oint_{S_j} \mathbf{A} \cdot d\mathbf{s} \right]$$

$$\lim_{\Delta v_j \rightarrow 0} \left[ \sum_{j=1}^N (\nabla \cdot \mathbf{A})_j \Delta v_j \right] = \int_V \nabla \cdot \mathbf{A} \, dv$$

$$\lim_{\Delta v_j \rightarrow 0} \left[ \sum_{j=1}^N \oint_{S_j} \mathbf{A} \cdot d\mathbf{s} \right] = \oint_S \mathbf{A} \cdot d\mathbf{s}$$

$$\int_V \nabla \cdot \mathbf{A} \, dv = \oint_S \mathbf{A} \cdot d\mathbf{s}$$

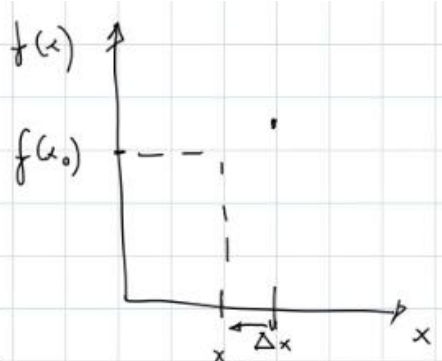


- Office hours via Skype with pdf capture for participants
  - Extremely popular
  - Also using in face-to-face courses
  - Students Skype in from everywhere (including just down the hall)

$f: \mathbb{R}^n \rightarrow \mathbb{R} \quad f \in C^\infty$  in point  $a = (a_1, a_2, \dots, a_n)$   
 $\Delta x_i = (x_i - a_i)$

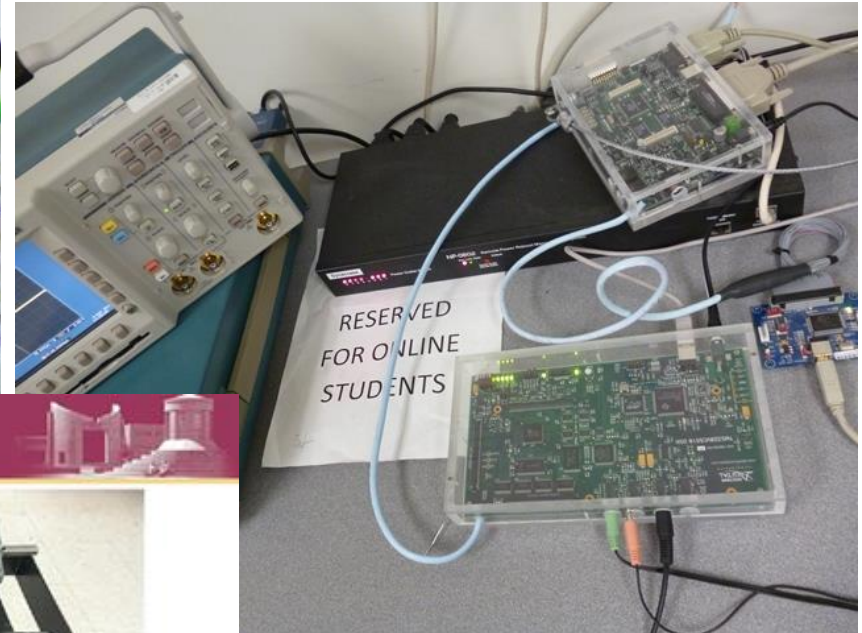
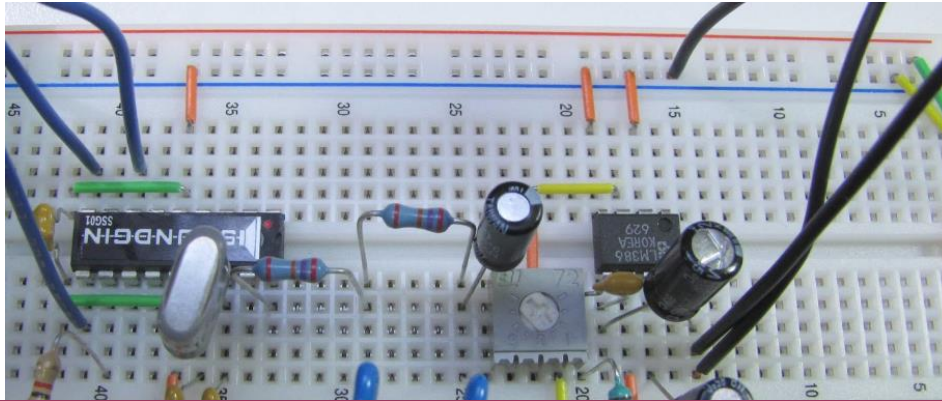
$f(x_1, x_2, \dots, x_n) = \sum_{j=0}^{\infty} \left[ \frac{1}{j!} \left[ \sum_{i=1}^n \Delta x_i \frac{\partial}{\partial x'_i} \right]^j f(x'_1, \dots, x'_n) \right]$

$x'_1 = a_1$   
 $x'_2 = a_2$   
 $\vdots$   
 $x'_n = a_n$



$\sum_{j=0}^{\infty} \left[ \frac{1}{j!} \right]$

- Labs: hardware kits, simulations, web controlled experiments



ARIZONA STATE UNIVERSITY



Do licenses allow remote access?  
 Matlab unusually allows  
 Cadence usually does not  
 International embargoes  
 International export control

# ECEDHA Corporate Members



**Agilent Technologies**



**ANALOG  
DEVICES**



**ECEDHA**

Electrical and  
Computer Engineering  
Department Heads Association

- Disclaimer: I do not represent ABET (but interact with ABET often).
- 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.





# ABET accredited 100% online programs

- ABET considers the following 11 programs at 9 schools to be 100% online:
  - Applied Science Accrediting Commission
    - 1 BS in Applied Science Program (Oakland U, Occupational Safety and Health)
    - 1 Associates in Applied Science Program (Trinidad St Jr College, Occupational S & H)
  - Technology Accrediting Commission
    - 2 BS Engineering Tech. Programs (Thomas Edison St College, Nuclear Energy Eng Tech, U Southern Mississippi, Construction Eng Tech)
  - Computing Accrediting Commission
    - 3 BS Information Technology/Information Systems (Regis U, Walden U)
    - 1 BS Computer Science, 1BS Networking (Regis U)
  - Engineering Accrediting Commission
    - 1 MS Engineering program (AFIT Systems Engineering)
    - 1 BS Engineering program (ASU Electrical Engineering)
  - Other accredited BS Electrical Eng. programs that are “mostly” online
    - U North Dakota (labs on campus)
    - Clemson U (EE courses)
    - U Stony Brook (upper division courses)
    - Morgan State U (2+2)
    - Others under development

- 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

## ■ II.H. Changes During the Period of Accreditation

II.H.1. The institutional administrative officer responsible for ABET accredited programs will **notify the ABET Senior Director for Accreditation Operations of changes** that potentially impact the extent to which an accredited program satisfies ABET accreditation criteria or policies. **A third party may also notify ABET** of a change to an accredited program. The institution provides ABET with detailed information about the nature of each change and its impact on the accredited program. Such changes include, but are not limited to:

...

### II.H.1.b.(2) **Methods** or Venues **of Program Delivery**

- E.g. Changing from offering 10% of the program online to 100% online
- You can expect ABET to require an **immediate interim report**

- Exam authentication
  - Several vendors, Institution pays for service
- Different student profile
  - few first-time freshmen
  - few full-time
  - mostly working
- Advising challenges
  - Transfer credit
  - Military deployments
  - Transfer credit
  - Old courses
  - Transfer credit
- Motivated, mature students!
  - Allows SOME scaling
  - Faculty-student interaction cannot be neglected
  - Not shy about complaining
- 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?)