EFFECTIVE TEACHING TECHNIQUES USING MATLAB AND SIMULINK

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OUTLINE

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OUTLINE

Motivation

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OUTLINE

- Motivation
- What involves Engineering Education?

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- Motivation
- What involves Engineering Education?
- Building practice into theory

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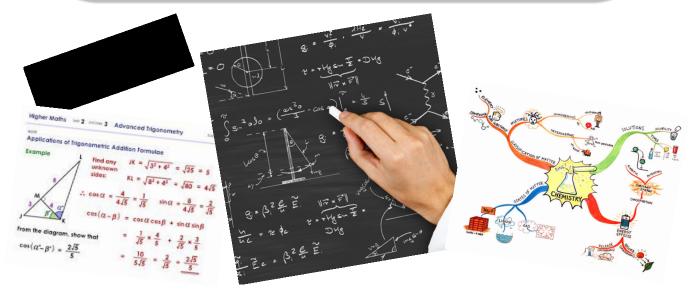
OUTLINE

- Motivation
- What involves Engineering Education?
- Building practice into theory
- Few case studies
 - General computation
 - Simulating dynamical systems
 - Building approximate linear models
 - ▶ Frequency-domain (spectral) analysis
 - Handling uncertainties and parameter estimation

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HIGH SCHOOL EDUCATION

Equations Pure sciences Trained for solving exact and pure problems



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ENGINEERING EDUCATION: CURRENT PRACTICE

- Maths & Sciences taught as pure subjects zero emphasis on applied aspects!
- Theory courses followed up with lab sessions across semesters
- Pure software courses (e.g., in MATLAB, ASPEN, etc.)
- Very little emphasis on intuition and perspectives
- Drawbacks:
 - Cannot place mathematics and sciences in context
 - Disconnect between theory and practice
 - ▶ Theory is not understood and practice is boring
 - Graduation without realisation

RISKS

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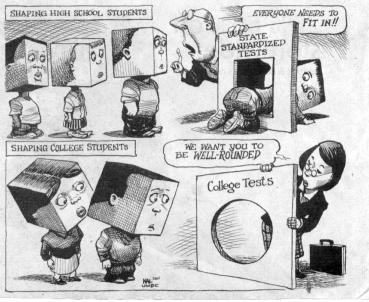
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RISKS



RISKS





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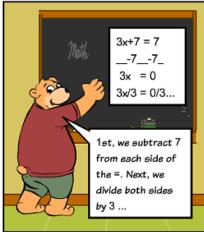
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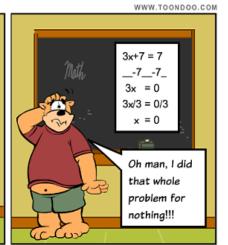
WHAT HAPPENED TO INTUITION, PRACTICALITY?

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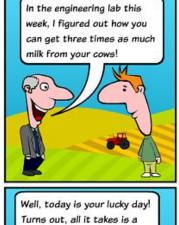
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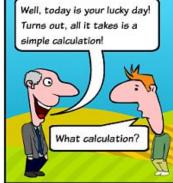
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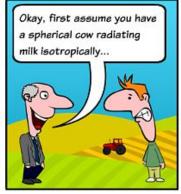
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END RESULT

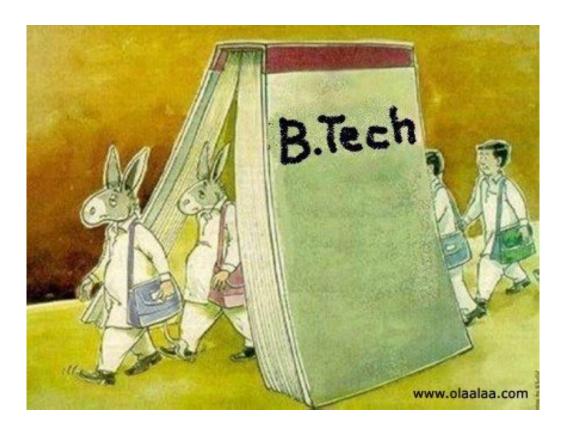
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END RESULT



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END RESULT

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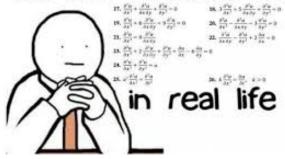
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ENGINEERING EDUCATION: WHAT IS NEEDED?

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I'm still waiting for the day that I will actually use



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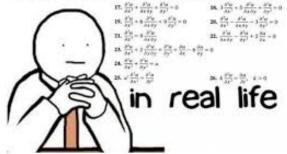
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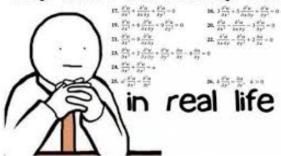


Show how math and sciences, blend and get into action.

Teach how probability and statistics are useful!

ENGINEERING EDUCATION: WHAT IS NEEDED?

I'm still waiting for the day that I will actually use



Show how math and sciences, blend and get into action.

Teach how probability and statistics are useful!

- 1. How do equations get into action! (**Equactions**?)
- 2. How to deal with **uncertainties?**
- 3. How to **estimate?**

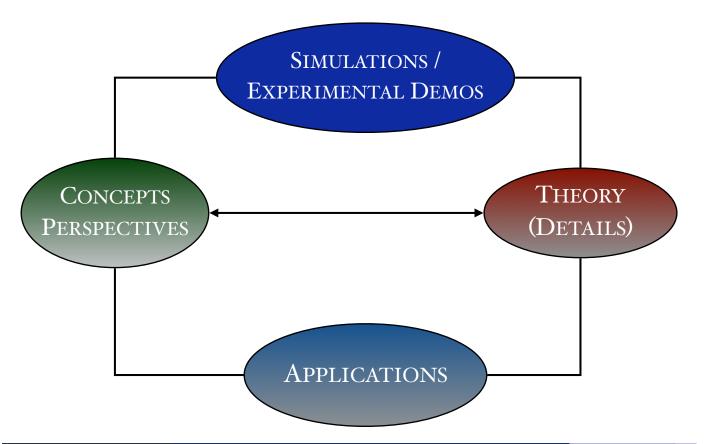
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CONNECTING CONCEPTS WITH DETAILS



TO REMEMBER

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TO REMEMBER

A lecture is worth thousand reads

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TO REMEMBER

A lecture is worth thousand reads

A picture is worth thousand words

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TO REMEMBER

A lecture is worth thousand reads

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Simulation is worth thousand lectures!

TO REMEMBER

A lecture is worth thousand reads

A picture is worth thousand words

Simulation is worth thousand lectures!

Healthy blend of **technology, analogies, similitudes, theory**and practice makes a complete package

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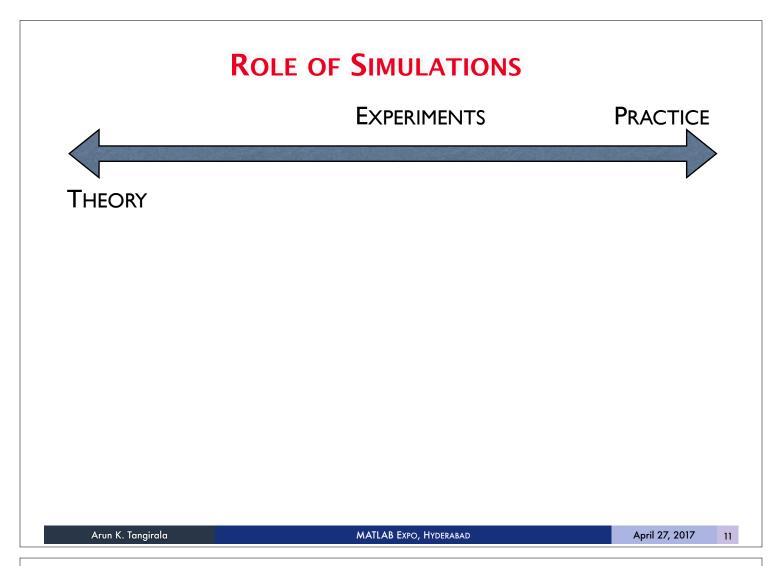
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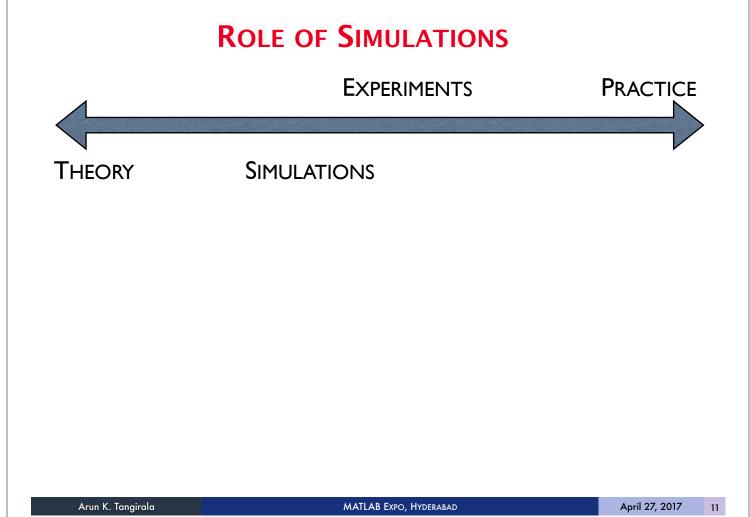
ROLE OF SIMULATIONS

PRACTICE

THEORY

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EXPERIMENTS

PRACTICE

THEORY

SIMULATIONS

What can simulations offer?

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ROLE OF SIMULATIONS

EXPERIMENTS

PRACTICE

THEORY

SIMULATIONS

What can simulations offer?

Powerful reinforcements and supplements for theory

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ROLE OF SIMULATIONS

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SIMULATIONS

What can simulations offer?

- Powerful reinforcements and supplements for theory
- Building highly effective motivational and practical case studies

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ROLE OF SIMULATIONS

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SIMULATIONS

What can simulations offer?

- Powerful reinforcements and supplements for theory
- Building highly effective motivational and practical case studies
- Excellent tools for zones where theory fears to tread

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ROLE OF SIMULATIONS

EXPERIMENTS

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SIMULATIONS

What can simulations offer?

- Powerful reinforcements and supplements for theory
- Building highly effective motivational and practical case studies
- Excellent tools for zones where theory fears to tread
- Safe and effective substitute for experiments

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ROLE OF SIMULATIONS

EXPERIMENTS

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SIMULATIONS

What can simulations offer?

- Powerful reinforcements and supplements for theory
- Building highly effective motivational and practical case studies
- Excellent tools for zones where theory fears to tread
- Safe and effective substitute for experiments
- Opportunities for innovation and testing

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TEACHING PARADIGMS

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TEACHING PARADIGMS

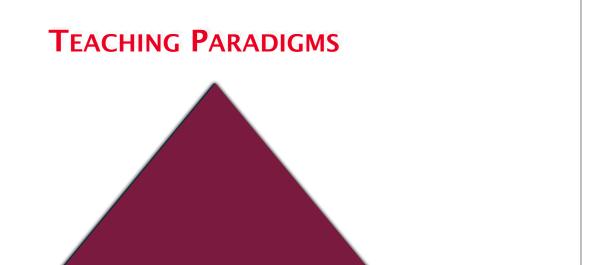
APPLICATIONS, NATURAL PHENOMENAEngineering, Medicine, Social Sciences, Law, Business, etc.

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SIMULATIONS, EXPERIMENTS

Practicing Aspects, Realities, Cross-validation, Testing, Design, Discoveries

APPLICATIONS, NATURAL PHENOMENA

Engineering, Medicine, Social Sciences, Law, Business, etc.

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TEACHING PARADIGMS

INTUITION

Concepts, Ideas, Perspectives

SIMULATIONS, EXPERIMENTS

Practicing Aspects, Realities, Cross-validation, Testing, Design, Discoveries

APPLICATIONS, NATURAL PHENOMENA

Engineering, Medicine, Social Sciences, Law, Business, etc.

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TEACHING PARADIGMS

THEORY

Abstraction, Fundamentals, Equations

INTUITION

Concepts, Ideas, Perspectives

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TEACHING PARADIGMS

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Abstraction, Fundamentals, Equations

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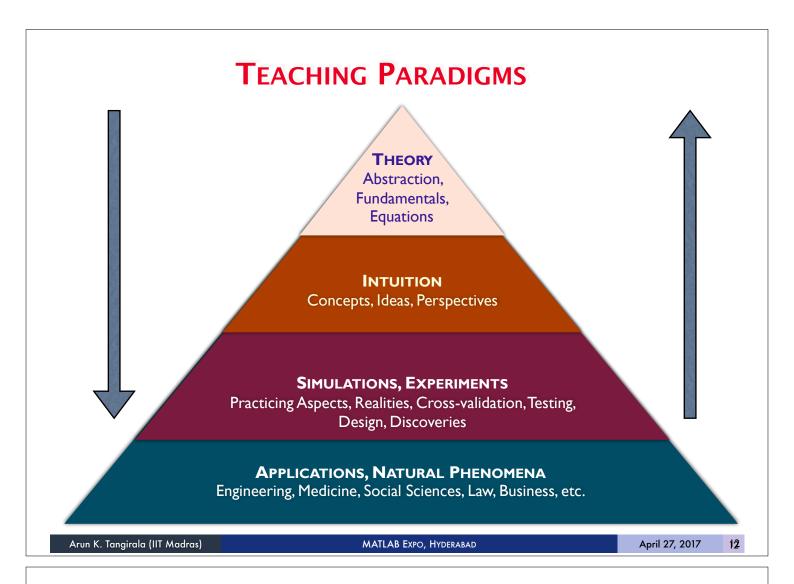
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CASE STUDIES

- Elementary computing
 - ▶ MATLAB
- Understanding and simulating dynamical systems
 - ▶ MATLAB and SIMULINK
- Approximating non-linear systems through linearisation
 - ▶ MATLAB and SIMULINK
- Signal estimation and Fourier transform
 - ▶ MATLAB
- Simulating uncertainties and parameter uncertainties