Best practices for curricula in Embedded Systems

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Agenda

1. An *didactic* analysis of the subject
2. Current trends
3. Best practices
4. Implications for Curriculum design
The analysis
Balances

Depth – Breadth
Knowledge – Skills
Academic – Industrial
Theory – Practice
General - Specific
Legitimacy

Formal

Functional

Requirements from the society/industry/…
For example, how the requirements are specified
Identity

Characteristics of the subject, is it a discipline or a theme? What’s the difference?

Hint: multidisciplinary areas, like mechatronics, typically starts as themes, such as robotics
What do we teach? Breadth or depth, a little of everything or everything of something
Communication

Active

Interactive

How do we communicate/teach? Open-loop or closed-loop? Interactive also means that the selection of the subject is dependent on previous knowledge, skills
Embedded Systems
Conclusions, so far

- Identity
- Disciplinary
- Traditional university education

- Embedded Systems
- Functional
- Thematic

- Selection
- Representation
- Traditional university education

- Interactive
- Exemplification
- Communication
- Active
Trends
Current trends

CDIO (an old trend)
ABET (even older trend)
INCOSE

MOOCs
E-Learning
Design thinking
Current trends

CDIO

~2000, ABET, Boeing, et al presented lists of wanted skills, abilities, relating to real-world engineering

CDIO = Improve engineering fundamentals and create engineers ready to engineer

KTH 2014

Improve scientific focus, adapt to ranking systems, program evaluations
Current trends

ABET

Accreditation Board for Engineering and Technology (US). Assess outcome of engineering programs. Examples of criteria:

1. An ability to apply knowledge of mathematics, science and engineering
2. An ability to design and conduct experiments, as well as to analyze and interpret data
3. An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, societal, political, ethical, health and safety, manufacturability, and sustainability
4. An ability to function on multi-disciplinary teams
5. An ability to identify, formulate, and solve engineering problems
Best practices
Best practices (?)

Caspi et al, Guidelines for a graduate curriculum on embedded software and systems. ACM Transactions on Embedded Computing Systems.

Grimheden and Törngren, How should embedded systems be taught?. ACM SIGBED Review.

WESE: workshops on Education in Embedded Systems
T-Shaped People and Design Thinking
Design Thinking

Design Thinking ≠ Analytical Thinking

Design Thinking = utilize both analysis and synthesis
The T-shape

Find the balance between depth and breadth
And between analysis and synthesis

Combine with complementary skills

Teach experts, with various expertise, able to synergistically work with other experts.