

Looking Ahead to 2020

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Applications of Engineering Systems

- “I thought that systems engineering was trying to solve difficult problems, but I now realize that engineering systems is trying to solve even more difficult problems.” Heinz Stoewer, 2004
- Examples
 - Health care
 - Energy and environment
 - Transportation
 - Financial services
- My hope is that by 2020, if not sooner, ES will be recognized as making significant contributions to such problems
- Our former MIT dean wanted to know if there are important problems that are not in the purview of engineering systems
 - Humans must play an important role in the system for it to be an engineering system. Or else the system needs to be extremely complicated
 - Leaves many problems for engineering scientists to work on

Engineering Systems Fundamentals

- Complexity
 - The term means different things to different people (e.g., Joe Sussman)
- ilities
 - Flexibility, robustness, resilience, safety, sustainability,...
 - We want to be able to design such properties into our systems
- Network Science

Such fundamentals all need to be understood in greater depth by 2020

New MIT Press ES series will publish texts and monographs on what we know now on ES fundamentals and their applications

System Architecture

- Architecture is different in Computer Science than in most engineering disciplines
- Levels of abstraction is a key notion in CS
- If a platform is a good idea, then a platform on top of a platform might be a better idea
- This works in CS in part because the bases can be relatively stable (e.g., a microprocessor)
- In most engineering systems a change in a module may necessitate changes in many other modules. In CS a change at the top need not affect any of the lower layers

More generally, we need to examine the fundamental assumptions of each engineering field, and learn from each other as much as possible as well as from management and the social sciences

Culture

- What makes for a good system architect?
 - Systems thinking
 - Holistic thinking
- Psychological experiments
 - Americans vs. Japanese students
- One-of vs. family of systems

We need to make progress on understanding these issues
by 2020