

Introduction to Engineering Practice

Overview of Information and Systems Engineering

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What is this ISE thing all about?



- ISE stand for Information and Systems Engineering.
- What is a system?
- And why would we want to engineer it?
- What does all this have to do with information?
- These are all important questions.
- I hope you will find answers to them in the next five weeks.
- Some of these questions will be answered today.
- Please feel free to raise any questions that occur to you as we go along.

The World According to Thomas Friedman



- First, a little history.
- Who is Thomas Friedman?
- According to Thomas Friedman, the world has been undergoing a second industrial revolution that began with the fall of the Berlin Wall.
- The first industrial revolution was largely enabled by improvements in the world's transportation infrastructure.
- These improvements shrank the world a few sizes.
- The current revolution has largely been enabled by improvements in the world's information infrastructure.
- These improvements have shrunk the world a few more sizes.
- Both companies and countries increasingly trade in information.

How Much Does Information Weigh?



- During the cold war, the economy of a country was measured by the total weight of their exports.
- The more tonnage leaving your country's ports, the stronger your economy.
- Today, a company's worth has more to do with intellectual property than physical property.
- One no longer asks how heavy a country's total exports are, but how light.
- There is a high negative correlation between the weight of a country's exports per dollar of GDP and the country's prosperity.
- The value added is information.

The Speed of Information □



- Information moves much more quickly than physical goods.
- In today's economy, the winners are companies that can keep up with the speed of information.
- Those who take advantage of the information revolution to improve engineering practices will be successful.
- Those who continue to practice traditional engineering will be left behind.
- Efficient use of information allows companies to be leaner, faster, and more efficient.
- It's no longer about how big a company is, but how fast.

The Rise and Fall of IBM (A Brief History) □



- From the 1950s through the 1980s, International Business Machines had profits of 10-15% and grew at a rate of 10-15% a year.
- In 1981, when IBM introduced the IBM PC, it was an industry leader.
- By 1985, IBM had revenues of \$50B and over 400K employees.
- Compaq, which didn't even exist in 1981, had revenues of \$0.5B and less than 2K employees.
- When Intel released its 386 chip in 1986, IBM balked and told Intel it was not ready for the chip.
- Compaq took the chip and invented the world's first "portable" PC.
- Compaq also took a huge chunk of IBM's market share and became the fastest growing company in history.
- By 1995, Compaq overtook IBM as the number one PC manufacturer.
- By 1998, Compaq had 50 times more revenue than it had in 1985, whereas IBM's had only grown 50%.
- Compaq was the Forbes Company of the Year in 1997 and the industry leader in PC shipments for 1998.

The Rise and Fall of Compaq □



- Compaq was smaller than IBM, but it took market share by being faster, more agile, and more adaptable to change.
- Compaq soon got a taste of its own medicine.
- Founded in 1984, Dell computer overtook both Compaq and IBM to become the number one PC manufacturer in the U.S. in 1999.
- By 1999, IBM's U.S. market share was down to 5.5% and
- Dell did this by being even leaner and faster than Compaq.
- The Dell revolution
 - Take orders over the Internet.
 - Commoditize every PC component.
 - Build new PCs on demand to customer specs.

The Rise of Google □

- Google is a company whose entire business is to help people find and use information fast.
- The estimated worth of the company is \$25B.
- Question: What is Google's product?
- Answer: Information.
- Underlining Google's importance to the new economy, the company was featured on the cover of Newsweek last week.

Enterprise Resource Planning□

- Companies can be viewed as large, complex systems consisting of thousands of interconnected components.
- Increasingly, companies are being run using software called *Enterprise Resource Planning* (ERP) software.
- ERP software helps a company allocate its resources efficiently by organizing information centrally for access by decision makers.
- ERP software is one of the fastest growing segments in the business software market.
- *Advanced Planning and Scheduling* (APS) software works with ERP software to help decision-makers make better decisions.

Lehigh's Information and Systems Engineering Program □

- Tom Magnanti, Dean of Engineering at MIT, in a speech at Lehigh last week, listed four emerging “hot” areas of engineering.
 - Bio: Bioengineering, computational biology
 - Info: Information systems, information technology
 - Nano: Nanotechnology, micro-manufacturing
 - Macro: Large-scale, complex systems
- The ISE major lies at the intersection of Macro and Info and focuses on:
 - systems engineering in the information age,
 - using information and information technology to solve problems,
 - analyzing large-scale systems to improve their performance, and
 - using information to make better business decisions and improve traditional engineering practices.

Systems Engineering Applications □

- Logistics Systems
 - Design of Distribution Networks
 - Facility Location
- Communications Networks
 - Internet
 - Wireless
- Manufacturing Systems
 - Production Scheduling
 - Shop Floor Layout
- Financial Systems
 - Mutual Funds
 - Pensions
- Biological Systems

Main Components of Program □

- Course emphasis areas
 - Information Systems and Technology: Emphasizes necessary skills in computing, software systems, and networking/communications.
 - Business and Finance: Emphasizes the broader context of business and analysis of economic and financial issues.
 - Operations Research and Systems Engineering: Emphasizes the modeling and analysis of complex, large-scale systems.
- Other requirements
 - Industrial internship
 - Capstone design course

What can I do with an ISE degree?

- Because of ISEs inherently multi-disciplinary nature, the options are highly varied.
- Some examples
 - Systems/operations analyst
 - Management consultant
 - Financial analyst
 - IT Specialist
 - Systems integrator
- With strong business and technical skills, ISEs eventually move to leadership roles in the companies they work for.

Some Buzzwords to Remember□

- Operations Research
- Management Science
- Mathematical Programming
- Supply Chain Management
- Enterprise Resource Planning
- Advanced Planning and Scheduling