Challenges in Satisfying the Need and Promotion of Modeling & Simulation Workforce

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Introduction and Background

Bachelor’s of Industrial Engineering Purdue University, 1988
Master’s of Industrial Engineering Purdue University, 1990
Pritsker Corporation – discrete event modeling for capacity planning and scheduling
Ph.D. Department of Industrial Engineering Arizona State University, 1996 – “Robust Deterministic Scheduling through Capacity Hedge Points”
Intel Corporation – 1997
• Discrete Event Simulation
• Full Factory Modeling
• Big Data
• Digital Twin
• Predictive Analytics
• Prescriptive Analytics
Geographically Diverse Manufacturing Capacity

- Wafer Fabs
- Assembly & Test

Intel Worldwide Headquarters
Santa Clara, California
Growing Demand for Modeling

- Models are becoming much larger as we model end-to-end systems
- Complexity of the moving parts combined with uncertainty and variability make solutions highly intractable, but ideal for simulation modeling
- Highly competitive, highly dynamic business environment requires alternative scenario evaluation
- Expected precision for multiple scenario evaluation is very high
- Fast turn of results to enable time to react
- Quantitative evaluations
- Requires a department, not a team of 1 or 2 modelers (sitting in the corner)
Operations Research Engineer

1. Engineer – calculus, chemistry (lab), physics (lab), mechanics (static & dynamics), thermodynamics, linear circuit analysis, computer programming

2. Industrial Engineer – probability, statistics, computer programming, optimization, simulation, manufacturing process, integrated production systems, control systems, engineering economics

3. Model Developers – 1 and 2 are prerequisites to being model developers. Developing models: simulation, optimization and data model of systems for purpose of analysis. This is the key differentiator of an operations research engineer

4. Programming – delivering the software solution. Implement solutions that support the factory, in some cases 24/7 – 365.

5. Analyst – using experimentation, statistical methods and modeling intuition provide quantitative results for decision support.
Operations Research Engineers

- Bureau of Labor Statistics indicates a much faster than average growth 25%

- US News & World Report ranks the field as #4 Best Business Jobs, #10 Best STEM Job and #20 overall Best Job

- US News and World Report and Glass Door indicate pay good, low stress
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What’s the problem?

- Competition for talent
- Demand is an order of magnitude greater, and pay is higher
- Pipeline is limited
Strategy in a Competitive Market for Talent

- Recognize the environment and the challenge
- Coordinate and communicate as a community with a common goal
- Investment of time and money
- Develop a strategy as a community
  - Educate
    - Management as to the need to invest in DES modeling talent
    - Department heads at the university to support DES modeling classes
  - Differentiate
    - Operations research engineers vs. software engineers vs. programmers
    - Discrete event simulation vs. Machine Learning and Deep Learning
  - Advertise
    - Connect with faculty, fund basic research
    - Offer internships specifically in modeling
- Develop and grow a pipeline of talent for the modeling community
Barriers to Success

- Simulation modeling projects take too long to complete
  - Modeling must move into the cadence of the business cycle
  - Appropriate levels of abstraction, incremental improvement
  - Develop capability in advance of need
  - Automate components
  - Digital Twin

- Simulation models are rarely understood
  - Educate a senior advocate, be the business evangelist
  - Develop a track record of solutions to highly intractable problems

- Simulation is not used regularly (optional)
  - Connect your product to the business, making it mainstream
    - Factory – Digital Twin
    - Business – Quarterly demand forecast
Community with Simulation Job Openings on Google

- Education or experience using discrete event simulation models or commercial simulation software such as Arena, Simio, ProModel, etc.