ISyE 4803-REV Advanced Manufacturing Systems Modeling and Analysis
Summer 2019
Spyros Reveliotis
e-mail: spyros@isye.gatech.edu
Homepage: www.isye.gatech.edu/~spyros

Course Meeting Times: M,T,W,TH 14:35-16:25 pm
Course Classroom: Clough Commons 102
Instructor Office Hours: M,T,W,TH 10:30 -11:45 am or by appointment
Course TA: Michael Ibrahim (email: mibrahim37@gatech.edu)
TA Office Hours: TBD (Main 414)

Course Objective

This "Advanced Manufacturing" course will introduce the students to an in-depth modeling and analysis of the workflow dynamics that shape the operation and the performance of contemporary production systems. Building upon the analytical background on stochastic modeling that is provided in 2027, 2028 and 3232, this course will develop systematic and rigorous models for the study of the considered environments.

At the same time, it will offer the students the experience of applying their formal background in stochastic modeling and analysis to practical problems and applications. In fact, a further intention of the course is to teach the students not only the particular models and algorithms that are covered in it, but also the thinking processes and the broader methodology that underlie the development of the presented results. Developing this skill is important for an effective application of the course material, in the face of the extensive complexities and intricacies of the modern production systems.

Finally, it must be pointed out that, while the course material will be motivated and presented primarily through applications drawn from the manufacturing domain, for specificity and concreteness, this material finds further applicability in any other application domain involving a structured workflow, like in health care and other service-related industries.

Tentative Course Outline

1. Introduction: Course Objectives, Context, and Outline
    *   Manufacturing System as a Transformation Process, Operations Management, and the role of Corporate Strategy
    *   Contemporary high-volume (discrete-part) manufacturing systems and their modeling as stochastic systems
    *   A taxonomy of the considered manufacturing systems based on their workflow management: Synchronous vs. Asynchronous, and Push vs. Pull and CONWIP models
    *   Course overview
2. Design of Synchronous Manufacturing Systems / Assembly Line Balancing
3. Modeling, Analysis and Design of Single-Station, Push-Controlled Manufacturing Systems as G/G/m queues
4. Modeling Preemptive and Non-Preemptive Operational Contingencies
5. Extension of the results to multi-stage, single-product, push-controlled manufacturing systems
6. Modeling and analysis of multiple-product manufacturing systems

7. Batching schemes and their complications
8. Modeling and analysis of certain pull-controlled manufacturing systems as closed queueing networks
9. Introduction to (combinatorial) scheduling theory

Course Prerequisites

Familiarity with Stochastic / Probabilistic Modeling and some Deterministic Optimization is expected. The main course prerequisite is ISyE 3232.

Course Reading Material

Textbook: G. L. Currry and R. M. Feldman, *Manufacturing Systems Modeling and Analysis* (2nd ed.), Springer, 2011.

The above text will be a substantial base for the course development. Additional supplementary material will be provided either in class, or through a course website accessed from the instrucrtor's homepage, or through the library electronic reserves (in case that copyright clearance is necessary).

Course Policies

Homework: Homework will be assigned every time that a course unit is covered, and its primary intention is to help the students internalize the material by applying it on a number of problem instances. Some of the assigned questions and problems might also serve the additional objective of strengthening the modeling and analytical capabilities of the students by asking them to provide certain extensions and modifications of the results presented in class. Homework can be worked out in teams, but each student must turn in his/her own write-up and any occurring collaboration and interaction must be reported in the write-up itself.

Exams: There will be three exams spread out quite evenly along the semester but their exact dates will be determined based on the course progress. **No collaboration or any other type of interaction is allowed for the exams.**

Grading Scheme:
- Homework: 25%
- Midterm Exam I: 25%
- Midterm Exam II: 25%
- Final Exam: 25%

Finally, it is expected that throughout the course development, students will abide by the Georgia Tech Honor Code.