SPRING 2008

CS 386: Model-based Diagnosis

Time: Mon.-Wed. 3:10-4:25 pm. **Location:** FGH 313

Instructor: Professor Gautam Biswas **Telephone:** 343-6204

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Office Hours: tbd.

Prerequisites: CS 274, CS 376, or equivalent, or permission of instructor.

Focus of class: We will study a variety of model-based diagnosis techniques for dynamic systems. This will include the traditional Kalman filter, observer-based, and parameter estimation methods for diagnosis, diagnosis with discrete-event models, symbolic diagnosis methodologies (AI techniques). Diagnosis of systems typically covers the fault detection, fault isolation, and fault identification tasks. Our emphasis in this course will be on physical and technical systems, and the types of faults that we will focus on include additive and multiplicative process faults (i.e., faults in the sensors, actuators, and in the process itself). Fault profiles are typically classified as abrupt, incipient, and intermittent. We will study abrupt and incipient faults, but avoid intermittent faults, which are generally hard to diagnose.

After studying the traditional diagnosis methodologies and algorithms, our focus will change to current topics: Diagnosis of nonlinear systems, Qualitative methods, Dynamic Bayes Nets, sequential Monte Carlo methods (Particle filters), Diagnosis of Hybrid Systems, and Diagnosis of complex, interacting distributed systems. In addition, depending on student interest, we will selectively cover topics like Health Monitoring of systems, Prognostic Analysis, Performance monitoring, and Fault-Adaptive control.

There is no text book for the course. We will be reading and discussing some book chapters, journal and conference papers, and even recent technical reports. I will make most of the material accessible on the course website. In certain cases, I may provide hard copies of papers, and students can make a Xerox copy of the paper for their own use.

Initial set of Topics:

- Lecture 1: Introduction to Fault Detection and Diagnosis and review of course contents.
- Lectures 2-3: Overview of Modeling Methods for Dynamic Systems
- Lecture 4: Introduction to the Kalman Filters.
- Lecture 5 on – We will start with the Parity equation method. Details of all of the topics to be covered will be announced by Lecture 3, and list of reference papers will be provided for each topic covered.

Grading:

Grading for the course will be based on the following:

1. Home Work: Implementation of Diagnosis Algorithms in Matlab. – 30%
2. Presentation of at least two papers as classroom lectures. – 20%
3. Participation in classroom discussions. – 10%
4. Class Project – 40%