

## Workshop Proposal for the 2009 American Control Conference

*Proposed Title: Engineering Applications in Genomics*

*Proposed Duration: 2 Days*

### Instructors

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### Description

Genomics concerns the study of large sets of genes with the goal of understanding *collective* function, rather than that of individual genes. Such a study is important since cellular control and its failure in disease result from *multivariate* activity among cohorts of genes. Very recent research indicates that engineering approaches for prediction, signal processing and control are quite well suited for studying this kind of multivariate interaction. The aim of this workshop will be to provide the attendees with a state of the art account of the research that has been accomplished in this field thus far and to make them aware of some of the open research challenges.

The workshop will provide a tutorial introduction to the current engineering research in genomics. The necessary Molecular Biology background will be presented and techniques from signal processing and control will be used to (i) unearth intergene relationships (ii) carry out gene based classification of disease (iii) model genetic regulatory networks and (iv) alter (i.e. control) their dynamic behavior. The workshop will be divided into two parts. On the first day, we will focus on building up the necessary molecular biology background. **NO PRIOR EXPOSURE TO MOLECULAR BIOLOGY WILL BE ASSUMED.** On the second day, we will discuss the application of engineering approaches for attacking some of the challenging research problems that arise in genomics related research.

### Workshop Outline

1<sup>st</sup> Day: Introduction to Molecular Biology

- (a) Review of organic chemistry
- (b) Proteins
- (c) DNA and RNA
- (d) Transcription and Translation
- (e) Gene Regulation
- (f) DNA Technology
- (g) Cell Cycle Control and Cancer

2<sup>nd</sup> Day: Engineering Applications

- (a) Data Extraction from Expression Microarrays
- (b) Clustering
- (c) Classification and Expression Prediction
- (d) Modeling of genetic regulatory networks
- (e) Control of genetic regulatory networks
- (f) Open Research Problems

Detailed Notes will be provided for the sections covered along with power point slides for the presentations. A preliminary reference for the workshop content is:

**A. Datta** and **E. R. Dougherty**, [Introduction to Genomic Signal Processing with Control](#), CRC Press, 2006.