ME 697Y SYLLABUS - SPRING 2018

Intelligent Systems: Modeling, Optimization and Control

Course Web Site: http://engineering.purdue.edu/ME697Y/

Instructor:	Professor Yung C. Shin 494-9775 ME G082 Email: shin@ecn.purdue.edu
Lecture Hours:	Tue. and Thur., 10:30am-11:45am, ME2054
Office Hours:	Mon. and Wed., 11:00am-12:00pm
Course Objective:	The objective of this course is to provide a thorough introduction to the field of soft computing techniques and machine learning to modeling, optimization, and control. It highlights current topics and applications, addresses issues encountered in the development of applied systems, and describes a wide range of intelligent systems techniques, including neural networks, fuzzy logic, evolutionary strategies, and genetic algorithms. The course also demonstrates concepts through simulation examples and practical experimental results. Case studies are also presented from each field to facilitate understanding.
Required Texts:	*Intelligent Systems - Modeling, Optimization and Control*, by Yung C. Shin and Chengying Xu, CRC Press, Taylor & Francis Group, 2009
Grading:	short assignments = 50 % final project = 50 %
Prerequistes	ME475 or equivalent in classical control theory Some familiarity in modern control theory based on state-space representation
Programming skills	Matlab or C language-based programming

Course outline:

Topic	Number of Lectures

Intelligent Modeling (4.5 wks)

1. Introduction of soft computing techniques
2. Fuzzy logic systems; fuzzy sets, inferencing, fuzzy relation models, Tagaki-Sugeno models
3. Neural networks
4. Neuro-fuzzy systems
5. Modeling of dynamical systems

Optimization (2 wks)

1. Model-based forward optimization
2. Optimization methods: GA, Evolutionary algorithms, particle swarm optimization, etc.
3. Classifiers: Support vector machine
4. Application of model-based optimization to numerical examples
5. Application of model-based optimization scheme to practical problems

Intelligent Control (4.5 wks)

1. Neural control
2. Rule-based fuzzy control
3. Model-based fuzzy control
4. Stability analysis: passivity theorem, small gain theorem, Liapunov theorem
5. Fuzzy control for SISO nonlinear systems
6. TS fuzzy control: optimal control
7. Fuzzy control application to practical problems

Multivariate Systems and Applications (4 wks)

1. Intelligent control for MISO nonlinear systems
2. Knowledge-based multivariabe fuzzy control
3. Model-based multivariate fuzzy control
4. TS fuzzy control of systems with uncertainties