

MSE 4230: Industrial Controls in Manufacturing

Credit hours and contact hours: 3-0-0-3

Instructor: Donggang Yao

Textbook: William F. Smith, *Structure and Properties of Engineering Alloys*, McGraw-Hill, 2nd Edition, 1993.

Specific course information

Catalog description: Introduction to industrial controls in manufacturing, process modeling, control of continuous-variable processes, digital control, discrete control, and control of manufacturing systems.

Prerequisites: ECE 3710 – Circuits & Electronics

Course: Selected Elective

Specific goals for the course

Outcomes of instruction:

1. Describe the basic working mechanisms of common controllers, including PIs, PIDs, PLCs, and predictive and adaptive controllers.
2. Analyze control systems using mathematical tools, including Laplace transform, z-transform, and Boolean operations.
3. Design and analyze controllers for continuous control and discrete control.
4. Apply knowledge of industrial control to solve polymer/fiber engineering problems.

Student Outcomes:

- (1) An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
- (2) An ability to apply engineering design to produce solutions that meet specified needs with consideration for public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.
- (6) An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.

Topics covered:

1. Manufacturing fundamentals
2. Laplace transform and its use in control

3. Modeling and control of continuous-variable processes
4. Z-transform and its use in digital control
5. Predictive, adaptive, and neural net controllers
6. Boolean operations and its use in discrete logic control
7. Ladder logic diagrams and programmable logic controllers
8. Manufacturing systems
9. Production systems
10. Equipment interfacing and communications

Correlation between Outcomes of Instruction and Student Outcomes:

Outcomes of Instruction	Student Outcomes						
	1	2	3	4	5	6	7
Describe the basic working mechanisms of common controllers, including PIs, PIDs, PLCs, and predicative and adaptive controllers.	X						
Analyze control systems using mathematical tools, including Laplace transform, z-transform, and Boolean operations.	X						
Design and analyze controllers for continuous control and discrete control.	X	X					
Apply knowledge of industrial control to solve polymer/fiber engineering problems.		X				X	

School of Materials Science and Engineering Student Outcomes:

- (1) An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
- (2) An ability to apply engineering design to produce solutions that meet specified needs with consideration for public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.
- (3) An ability to communicate effectively with a range of audiences.
- (4) An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.
- (5) An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.
- (6) An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.
- (7) An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.