EMCH 575 - Adaptive Material Systems and Structures

Credit hours – 3  Contact hours – 50 minutes MWF or 75 minutes TTh

Instructor – Lingyu (Lucy) Yu


Specific Course information:
  a. EMCH 575 - Adaptive Materials and Smart Structures. (3) A multidisciplinary introductory course addressing the engineering field of adaptive materials and smart structures.
  b. Prerequisites: EMCH 210, EMCH 260
  c. Mechanical Engineering Elective

Course Goals:
  a. Outcomes
    1. The students will show the understanding of the use of adaptive material systems and structures for modern engineering applications.
    2. The students will show planning, scheduling, execution, and delivery skills in a teamwork environment.
    3. The students will develop written and oral communication skills in a teamwork environment.
    4. The students will have appreciation of the role of adaptive material systems and structures in modern society.
  b. Relationship of Course to Program Objectives: The importance of each course objective to meeting the program outcomes is indicated with the following scale: 3 = major importance; 2 = moderate importance; 1 = minimal importance. Blank if not related.

<table>
<thead>
<tr>
<th>Program Outcomes (see list for complete description)</th>
<th>Course Outcomes</th>
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<td></td>
<td>CO 1</td>
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<tr>
<td>1.1. analyze, design and realize</td>
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<td>1.2. computation techniques</td>
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<td>1.3. design and interpret experiments</td>
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<td>1.4. apply linear algebra, calculus</td>
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<td>1.5. apply statistical methods</td>
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<td>1.6. understand chemistry and physics</td>
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<td>2.1. engineering economic analyses</td>
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<td>2.2. plan and execute projects</td>
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<td>2.3. oral and written communications</td>
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<td>2.4. professional responsibility</td>
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<td>2.5. multi-disciplinary teams</td>
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Topics Covered:
1. Definition of adaptive material systems and structures. Active materials spectrum
2. Induced-strain actuation
3. Actuator applications of active materials
4. Lab demo #1 – experiments with induced strain actuators
5. Sensor applications of active materials
6. Lab demo #2 – experiments with active material sensors
7. Shape memory alloys (SMA)
8. Lab demo #3 – experiments with shape memory alloys
9. Magnetorheological fluids (MRF)
10. Lab demo #4 – experiments with magnetorheological fluids
11. Dynamic induced-strain actuation
12. Lab demo #5 – experiments with resonators
13. Dynamic sensing
14. Lab demo #6 – experiments with impact detection and acoustic emission
15. Waves
16. Lab demo #7 – experiments with waves generation and reception
17. Sensor-actuator (two-way transduction) applications of active materials for structural health monitoring and NDE
18. Lab demo #8 – experiments with electromechanical (E/M) impedance
19. Smart structures and composites
20. Project: research paper and presentation

Person Who Prepared This Description and Date of Preparation:
Victor Giurgiutiu (updated 02/10/2005)

Approved by Lingyu (Lucy) Yu 3/14/11