WUT2017S (May 04-11, 2017) SMART STRUCTURES AND STRUCTRONIC SYSTEMS: FUNDAMENTALS AND APPLICATIONS

LECTURE: Eight hours/Total (Lecture: Seven hours; Quiz: One hour)



INSTRUCTOR: Prof. Hornsen (H.S.) TZOU; ASME Fellow; Director, Interdisciplinary Research Institute of Aeronautics & Astronautics

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LABORATORY/ REVIEW MEETINGS: TBD (Only for design projects)

COURSE DESCRIPTION

Research and development of the emerging technology of smart structures and structronic systems have been evolving for three decades. Sophisticated multi-field/control coupling and multi-physics theories have been developed and numerous practical applications have also been proposed. This report focuses on histories, smart materials (e.g., piezoelectrics, electro-/magneto-/photo-strictive materials, shape memory materials, electro- and magneto-rheological fluids, polyelectrolyte gels, pyroelectric materials, magneto-optical materials, superconductors, etc.), precision devices (sensors and actuators), micro-/nano-actuations, smart structures, mechatronic and structronic systems, and photo-thermo-electro-magneto-mechanical systems encompassing elastic, temperature, electric, magnetic, light, and control interactions. Designs are emphasized; modern research issues are also discussed. (Project planning, management, and professionalism are strongly emphasized, if time allows.)

ESTIMATED CONTENTS: Engineering Design: 100%

GRADING: Quiz: One one-hour quiz (10 points); Letter Grade: 9-10: A; 8: B; 7: C; 6: D; < 6: E.

TOPICS (Tentative):

- 1. Introduction; piezoelectric devices and designs;
- 2. Electro/magneto/photo-strictive devices;
- 3. Shape memory devices and applications;
- 4. Electro/magneto-rheological materials and applications;
- 5. Designs and applications of polyelectrolyte materials, photostrictive materials, pyroelectric materials, magneto-optical materials, superconductors, etc.

REFERENCES

1. Tzou, H.S., Yue, H.H., Jiang J. and Ren B.Y., 2012, *Design of Smart Structures, Devices and Structronic Systems*," Harbin Institute of Technology Press, Harbin, China. ISBN: 978-7-5603-3364-9.

2. Tzou, H.S. and Anderson, G.L., 1992, "*Intelligent Structural Systems*," Kluwer Academic Publisher, Dordrecht/Boston/London.

3. Tzou, H.S. and Fukuda, T., 1992, "*Precision Sensors, Actuators and Systems*," Kluwer Academic Publisher, Dordrecht/Boston/London.

4. Tzou, H.S., 1993, "*Piezoelectric Shells: Distributed Sensing and Control of Continua*," Kluwer Academic Publisher, Dordrecht/Boston/London.

