

Introduction to Fluid-Structure Interaction (OSE 520)

Fall 2009 (Being Offered at KAIST)

TTh 10:30AM-11:45AM

Class Meets at OSE 308

Class Website:

http://www.colorado.edu/engineering/CAS/courses.d/OSE520/OSE520_2009.html

Course Description

This course covers essential elements of dynamics of elastic bodies, basic fluid mechanics, and their interaction. The course strives to offer a balanced coverage of theoretical aspects and modern computational methods for modeling, analysis and design of fluid-structure interaction systems.

Instructor

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and

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Office Hours

Instructor: MW: 10:00-12:00Hr.

Prerequisites

Exposure to graduate level math

Reference Books

1. Fluid-Structure Interaction, by H.J.-P. Morand and R. Ohayon. John Wiley & Sons, New York, 1995.
2. Modeling of Mechanical Systems: Fluid-Structure Interaction, by F. Axisa and J. Antunes. Elsevier, 2007.
3. Sea Loads on Ships and Offshore Structures, by O. M. Faltinsen. Cambridge University Press, 1990 .
4. Guidance and Control of Ocean Vehicles, by T. I. Fossen. John Wiley & Sons, New York, 1994.

Grading

Your grade in this course will be assessed by homework, exams, and class discussions with the following weights:

Homework 30%

Two mid-term exams: 30%

Final exam: 30%

Class participation: 10%

For distance learning students, there will be no class discussion requirement. The class discussion portion will be equally distributed into to midterm exams and projects (or final exams), i.e. two midterm exams will account 35% and final exam (or project) will account 35%.

Attendance

You are required to attend the class and are responsible for all materials and announcements in the class. Make-up class is only available in very special circumstances, such as illness.

Homework

Homework will be normally assigned on Thursdays. Homework will be due on the following Thursday before the class. It is your responsibility to check the class website to download homework assignments in time. E-mailing your homework is not accepted. Late homework will not be accepted unless arrangement is made with the instructor in advance and only under special circumstances, such as illness. Documents, such as doctor's note, should be presented to prove the special circumstances. Discussions on the homework are encouraged. Copying other people's homework, however, will result in no credit, and may lead to disciplinary action.

Policy Regarding Disabilities

If you qualify for accommodations because of a disability, please submit to me a letter in a timely manner so that your needs may be addressed.

Policy Regarding Religious Observance

Campus policy regarding religious observances requires that faculty make every effort to reasonably and fairly deal with all students who, because of religious obligations, have conflicts with scheduled exams, assignments or required attendance. In this class, it is your responsibility to notify faculty at least two weeks in advance of the conflict to request special accommodation for your religious observance. In general, one day religious holiday is not qualified as a reason for a delayed homework. In the case of conflict of religious holiday with exam, special arrangement can be made.

Policy Regarding Classroom Behavior

Students and faculty each have responsibility for maintaining an appropriate learning environment. Students who fail to adhere to such behavioral standards may be subject to discipline. Faculty have the professional responsibility to treat all students with understanding, dignity and respect, to guide classroom discussion and to set reasonable limits on the manner in which they and their students express opinions. Professional courtesy and sensitivity are especially important with respect to individuals and topics dealing with differences of race, culture, religion, politics, sexual orientation, gender variance, and nationalities. Class rosters are provided to the instructor with the student's legal name. I will gladly honor your request to address you by an alternate name or gender pronoun. Please advise me of this preference early in the semester so that I may make appropriate changes to my records.

Sexual Harassment Policy

The University of Colorado Policy on Sexual Harassment applies to all students, staff and faculty. Sexual harassment is unwelcome sexual attention. It can involve intimidation, threats, coercion, or promises or create an environment that is hostile or offensive. Harassment may occur between members of the same or opposite gender and between any combination of members in the campus community: students, faculty, staff, and administrators. Harassment can occur anywhere on campus, including the classroom, the workplace, or a residence hall. Any student, staff or faculty member who believes s/he has been sexually harassed should contact the Office of Student Counseling at 042-350-4714.

Policy Regarding University Honor Code

All students of KAIST are responsible for knowing and adhering to the academic integrity policy of this institution. Violations of this policy may include: cheating, plagiarism, aid of academic dishonesty, fabrication, lying, bribery, and threatening behavior. Incidents of academic misconduct shall be reported to the Department Chair. Students who are found to be in violation of the academic integrity policy will be subject to both academic sanctions from the faculty member and non-academic sanctions (including but not limited to university probation, suspension, or expulsion).

Course Content

Basic Interaction Models

- Examples of fluid-structure interactions**
- Lagrangian-Eulerian description of kinematics**
- Model equations for flexible structures**
- Fluid models for small-amplitude inviscid fluids**

Internal fluid-structure interaction

- Reduced-order models for structures and interaction compatibility**
- The problem of internal fluid waves with gravity**
- Liquid sloshing under surface tension**
- Dynamics of structures interacting with internal fluid waves**

External fluid-structure interaction

External fluid waves interacting with flexible structures

Approximate models for external acoustics-structure interactions

Examples of external acoustic-structure interaction problems

Winds and large ocean waves interacting with rigid and flexible structures

Eulerian and Lagrangian coupling procedures

Methods for incompressible fluids interacting with structures

Applications and special topics

To be chosen according to class preference