SENIOR DESIGN TOPICS AY 2022-23

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Topic #1
Acoustic Optimization for HVAC Systems

Subject areas: Acoustics, fluid mechanics, heat exchanger design, heat engine

A common problem in heating, ventilation, and air conditioning (HVAC) systems is undesirable noise levels from pipes and cavities with internal pulsating pressures. The senior design team will identify an HVAC system to address the issue. Engineers reduce radiated noise in HVAC and automotive systems by adjusting the acoustic impedance in their pipes and cavities using multiphysics simulation. The design team will develop an acoustic impedance optimization model using the fluid-structure interaction (FSI) and finite element analysis (FEA) capabilities of the ANSYS-FLUENT Multiphysics software. The design team will provide effective solutions for reducing the noise without affecting overall system performance.

Deliverable: A working model/prototype
Team composition: 3 MEM students
Sponsor: TBD

Topic #2
An Optimized Design of a Liquid Container for Minimizing Sloshing in Transit

Subject Areas: *air-water systems*, impact physics, *optimization theory*

The oscillation of a fluid caused by external force, called sloshing, occurs in moving vehicles containing liquid masses. This sloshing effect could be a severe problem in vehicle stability and control. Development of efficient and easy method to reduce sloshing effect is necessary. In this design project, an advanced general-purpose multi-physics simulation software package will be employed to model the sloshing dynamics in partially filled containers. The considered storage tank for fluid will be rectangular. The design variables are the width, the length and the height of the container and installation location of the baffle, and sloshing reduction coefficient by baffle. As a result of this study, the optimal design for sloshing reduction will be developed. The design of an experimental system (based on the availability of a shaker table) to verify the computational predictions will be carried out.

Deliverable: A working design tool
Team composition: 3 MEM students
Sponsor: TBD