

SMU Department of Mechanical Engineering
SEMINAR

**"Harvesting acoustic energy using a
straight-tube resonator"**

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Friday, October 14, 2011

3:00 p.m. – 4:00 p.m.

Location: Junkins 110

Abstract: Sound is abundant in our everyday life, especially in urban environments. Despite the prevalence of sound, it is difficult to harvest acoustic energy in practical applications due to its low power density. In this study, to increase the efficiency of acoustic energy harvester, multiple piezoelectric beams are placed in a straight-tube acoustic resonator. An external sound wave generates amplified acoustic pressure inside the tube at acoustic resonant frequencies. The amplified acoustic pressure drives the vibration motion of the piezoelectric beams, resulting in electrical power generation. Theoretical, numerical, and experimental studies of the straight-tube resonator are presented to obtain its optimized design. A finite element approach is used to optimize a Helmholtz resonator to a straight-tube resonator which has a large acoustic amplification at operating low frequencies. Piezoelectric PVDF films have been placed inside the tube to convert acoustic energy to electricity. Theoretical and numerical calculations for the output voltage and electric power will be presented and they will be verified by experimental measurements. Our study indicates that, for a single piezoelectric beam placed in the tube resonator, the beam displacement is large near the tube inlet and decreases as it is moved toward the tube end. Placing multiple beams inside the tube resonator increases the total power harvested.

Bio: Bin Li is currently a PhD student supervised by Prof. Jeong Ho You in Mechanical Engineering Department at Southern Methodist University. His research focuses on acoustic energy harvesting and remote charging system. Before joining SMU, he received bachelor (2005) and master degree (2010) both in South China University of Technology, Guangzhou, China.