Technion-Israel Institute of Technology
Faculty of Mechanical Engineering

הטכניון-מכון טכנולוגי לישראל
הפקולטה להנדסת מכונות

סמינריון

הנך מוזמן/ת להרצאה סמינריונית של הפקולטה להנדסת מכונות, שתתקיים ביום ד׳ 5.09.2018 (כה׳ באלול, תשע״ח), בניין דן קאהן, אודיטוריום 1, 13:30.

מרצה: יאיר גרינברג

מנחה: פרופ׳ (אמריטוס) גרשון גרוסמן

על הנושא:

External phase shifting tuning mechanism in a miniature-pulse tube cryocooler using a semi-active electromagnetic damping system

The seminar will be given in Hebrew

תקציר ההרצאה :

The Pulse Tube (PT) cryocooler is a regenerative cryocooler which operates with oscillating pressure and mass flow and has no moving displacer at the cold end (such as in the Stirling and Gifford-McMahon refrigerators). The main advantage of such a cryocooler involves longer lifetimes together with high efficiency, essential for operational systems with high reliability requirements.

It was proved and investigated that the optimal phase relationship between the flow and pressure in a pulse tube cryocooler is that in which the flow at the regenerator midpoint is nearly in phase with the pressure, which infers a flow-to-pressure phase difference at the hot end, typically around -60 degrees.

The PT can gain such a phase difference by using an orifice or an inertance tube (IT) with a reservoir volume to store the gas during half a cycle. When scaling down such cryocoolers, the efficiency degrades since the resistive fluid impedance increases rapidly. A previous research proposed to construct a passively linear oscillating mass-damper mechanism, as a solution for flow-to-pressure phase shifting without the use of an inertance tube or an orifice. However, that device implementation was designed for a specific cold end temperature and a cycle operating frequency. In addition, mechanical tolerances affected the device performance.

In the seminar, both theoretical and experimental development will be presented, of semi-active electromagnetic damping mechanism in a miniature pulse tube cryocooler, to externally control the phase shift and amplitude at the hot end of the cryocooler. The mechanism included a voice coil suspended on a silicon diaphragm and a flexural bearing. The goal was to obtain the optimum cycle operational point and thus improve the cryocooler performance. During experiments, a stick-slip phenomenon inherent to the voice coil influenced the cryocooler performance. However, the results show that the cold end temperature was externally tuned, and provided a proof of concept for the application of external phase shift and amplitude tunable mechanism..

בברכה,

פרופ"א מתי סאס
מרכז הסמינרים