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 ה' 11.10.2018 (ב' בחשון, תשע"ט), בניין דן קאהן, אודיטוריום 1, 13:30.

מרצה: אילי בנבניסטי

מנחה: פרופ' דוד אילתה

על הנושא:

Surface waves in elastic layers of finite thickness, and their relation to mode ordering in resonating disk gyros

The seminar will be given in Hebrew

תקציר ההרצאה :

MEMS gyroscopes are becoming prevalent in smartphones and other hand held devices. One type of a MEMS gyroscope is based on a resonating disk (Disk Resonating Gyro - DRG). In DRG devices, one vibrational wineglass mode is driven at resonance, at constant velocity amplitude - the drive mode, and rate of rotation around the out-of-plane axis transfers some of the kinetic energy to an orthogonal vibrational wineglass mode – the sense mode. Proper operation of the DRG requires that the drive and sense modes have the same natural frequency.

In recent years much effort has been invested in developing DRG devices for the consumer market. For compatibility and robustness of fabrication, many DRG devices are made from single-crystalline silicon, which is anisotropic. This anisotropy adversely affects the proper operation of the DRG. Specifically, in some vibrational wineglass modes, pairs of orthogonal modes occur at different frequencies .

A decade ago it was discovered that the third-order (triangular) wineglass mode is insensitive to material anisotropy. In this work we provide a new general rule for the sensitivity of wineglass modes to the material anisotropy.

Two years ago, it was discovered that in specific geometries of DRGs, the third-order mode occurs at a lower natural frequency relative to the second-order (elliptical) mode. This phenomenon is beneficial for gyros, but it was completely unexpected and it is yet to be explained. In this work we provide a new explanation to this phenomenon of frequency mode-ordering.

To achieve all this, and by way of background, we first analyzed standing and propagating waves in an infinite plate with one clamped surface and one free surface. We discovered two new types of surface waves, the R-wave and the E-wave. We demonstrate how these waves are different from the classic Rayleigh waves, and from the classic extensional and flexural Lamb waves. Finally, we present properties of the R and E waves, and some additional possibilities for their use.

בברכה,

שפ"א אתיו סאס
מרכז הסמינרים