Special Seminar
"Toward High-Performance MEMS Accelerometer: Analytical Model for Low Frequency Vibration Rectification Error"

Organizer: Micro/Nano Machining Research and Education Center (MNC)
            S. Tanaka Laboratory, Tohoku University
Date/Time: 29 October 2024, 15:00-16:00
Room: MNC 3F Seminar Room

Lecturer: Dr. Kim Sandvik, MEMS design engineer, Murata Electronics Oy, Finland

Kim Sandvik received his Ph.D. in Physics in 2019 in Tohoku University, Japan. His research topic was quantum magnetism and neutron scattering at Taku J Sato Laboratory. Since 2020 he has worked for Murata Electronics Oy and has been the lead designer for various MEMS accelerometers.

Abstract: Vibration rectification error (VRE) is an important specification for high-performance MEMS accelerometers. Among the various factors contributing to VRE, nonlinearity stands out as a key cause of low-frequency VRE. In this seminar, I will present an analytical model specifically developed to calculate the low-frequency VRE in MEMS accelerometers. The model combines the frequency response of the output acceleration with the integration of simulated or calculated capacitance data over a 2π period to determine the offset signal at a given frequency. The model allows the study of various parameters affecting VRE. For example, in Fig. 1. the input AC acceleration dependency on VRE is shown. I will also discuss how the model is used to calculate VRE under geometrical non-idealities such as capacitance gap asymmetry between the differential sensing electrodes, which is utilized in our Monte Carlo simulation to calculate VRE over process variation (Fig. 2).
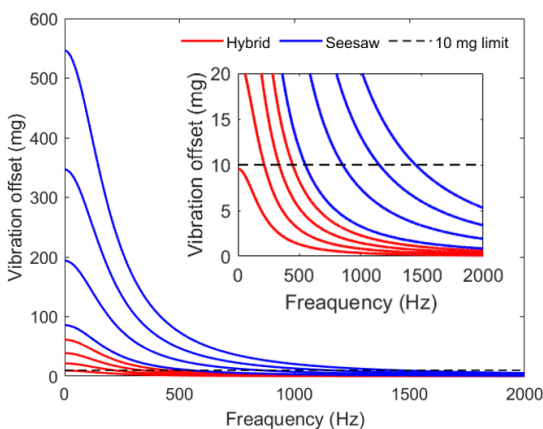
Fig. 1. Frequency dependent VRE of two different accelerometers (red and blue) with decreasing (10, 8, 6, and 4 g) input AC acceleration from up to down.
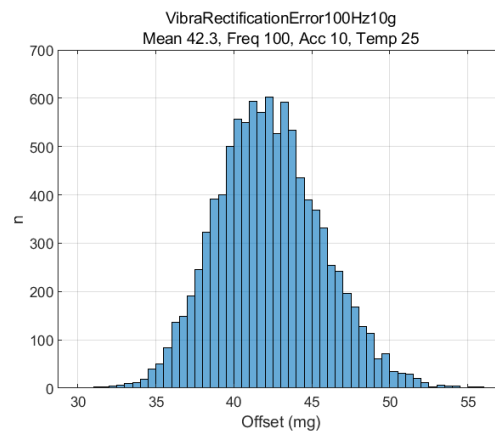

Fig. 2. Monte Carlo data of VRE at 100 Hz with 10g AC input.