# MECHANICAL ENGINEERING STUDENT SEMINAR

**Wednesday, September 04 2024 at 13:30**, D. Dan and Betty Kahn Building, Room 217.
**Online:** https://technion.zoom.us/j/96591795297?pwd=lwnb3xeQZMtPq7GJ6Oaw7ONo4qD96b.1

## Avalanches and post-avalanche relaxation processes

Haile Gebrehiwet Seyoum

**Adviser: Prof. Doron Shilo and Dr. Eilon Faran**

The non-elastic mechanical response of most materials occurs through impulsive and discrete events known as avalanches, which arise when a microscopic local region rapidly deforms, leading to a macroscopic strain change. Due to their transient nature and small spatial and temporal scales, studying avalanches experimentally poses significant challenges. Existing methods often suffer from insufficient sensitivity, such as in force measurements, or lack clear correlations between measured signals and the underlying physical processes, like with acoustic emission. In this work, we introduce a new experimental method using an acceleration measurement of avalanche events through a mass-spring system connected in line with the tested sample. We performed simultaneous measurements of force drops, acceleration, and acoustic emissions originating concurrently from the same avalanches during twinning deformation in a magnesium single crystal. Our results demonstrate that the acceleration measurements provide higher sensitivity compared to high-resolution force measurements and offer direct quantitative information into the avalanche source, such as the local twinned volume. Furthermore, we observe that each avalanche, which occurs at the $\mu s$ time scale, is followed by a relaxation process, which occurs at the $ms$ time scale and has not been discussed before. Interestingly, we show that the microscopic volumes twinned during the avalanche and the relaxation process are approximately equal. Such a correlation indicates a simple geometrical relation between the shapes of the twin at the ends of the avalanche and the relaxation, leading to a new understanding of how deformation twinning occurs.

Seminars Coordinator: Assoc. Prof. Shmuel Gal.