MECHANICAL ENGINEERING STUDENT SEMINAR

Thursday, March 23 2023 at 13:00, D. Dan and Betty Kahn Building, Auditorium 1.

An experimental and numerical investigation of laminated composite structure's damping capabilities

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In the last decade, composite materials have become one of the most interesting materials in the aviation, space, and defense industries. Usage of them has increased due to their high performance, the distinguishing features of these materials are their high specific strength and stiffness, together with the directionality of properties. It means that significant weight reduction may be achieved and at the same time control the mechanic properties. Conventional structures have many sources of energy such as bolts and rivetted joints, lubricated bearings, and so on. However, when using composite materials, it is usually necessary to use adhesive joints. This seriously reduces structural damping and makes material damping far more important. Hence the importance to understand the damping capabilities and their behavior in composite materials. Damping properties are of significant importance in determining the dynamic response of structures, and accurate prediction of them at the design stage, especially in the case of lightweight structures is very desirable. Damping parameters cannot be deduced deterministically from other structural properties and recourse is generally made to data from experiments.

An experimental study was carried out to investigate the effect of composite materials architecture on damping capabilities and compare it to conventional materials in our study aluminum which is very common in defense industries. This study conducted a series of different test methods and experimental apparatus. At first, several tests were performed to find mechanic properties using digital image correlation (DIC) measurement techniques. In the second step, eight different samples were produced, six of them designed from unidirectional laminates (UD) in two different thicknesses, 2 mm & 3 mm: a hard (cross-ply), a soft (±45), and quasi-isotropic laminates, two others were produced from Aluminum 7075. The tests were carried out using various techniques such as vibration, shocks, and hammer tests. The following analysis methods were implemented: bandwidth method, logarithmic decrement method, and modal analysis method to compare the damping ratio. Numerical processes were run on data measurements to find damping capabilities.

Note: the seminar will be given in Hebrew

Seminars Coordinator: Assoc. Prof. Matthew Suss.