Mechanical Engineering Seminar

Monday, January 6, 2025 at 14:30, D. Dan and Betty Kahn Building, Room 217

Online: https://caltech.zoom.us/j/3564692401

Hierarchical Design of Microalgae Biocomposites for Multifunctionality

Israel Kellersztein, Ph.D.
Division of Engineering and Applied Science
Caltech, Pasadena, CA, USA
Email: israelke@caltech.edu

Hosted by: Prof. Alon Wolf

As the need for sustainable, high-performance materials grows, creating eco-friendly alternatives to traditional composites has become increasingly critical. Renewable biomaterials, including bioplastics and natural fibers, offer a promising pathway toward sustainability. However, their incorporation in composites typically necessitates high-energy processing and harsh chemical treatments to achieve adequate interfacial adhesion. In this talk, I will present an additive manufacturing approach to fabricate microalgae-based biocomposites at ambient temperature, eliminating the need for petrochemical additives. This method produces lightweight structures with hierarchical architectures and complex geometries, demonstrating mechanical properties and thermal insulation comparable to conventional polymers and wood. The hierarchical organization and low density contribute to superior thermal-management capabilities, enabling efficient and isotropic heat dissipation compared to typical 3D-printed polymers. By integrating the bottom-up design flexibility of 3D printing with top-down control over material structuring, this approach enables the development of engineered biocomposites that meet the growing demand for sustainable materials in advanced applications and establishes a foundation for future exploration of hierarchically structured, multifunctional composites.

Israel Kellersztein is a postdoctoral scholar and Fulbright Fellow in the Department of Mechanical and Civil Engineering and the Resnick Institute for Sustainability at Caltech. He earned his Ph.D. from the Weizmann Institute of Science in 2020 and his M.Sc. from Shenkar College in 2015. His research focuses on hierarchical structures, multiscale properties, structural bioinspired composites, and advanced additive manufacturing.

Seminars Coordinator: Assoc. Prof. Gal Shmuel