DEPARTMENT OF AEROSPACE ENGINEERING | TECHNION Israel Institute of Technology

SUMMER PROGRAM

2024

Participating Faculty Members and Labs

Vladimir Martinusi

vmartinusi@technion.ac.il

My research is focused on Analytical Mechanics for Space Systems. I am interested in modeling and mitigating the effects of the gravitational (non-sphericity, uneven mass distribution, third body attraction) and non-gravitational (atmospheric drag, solar-radiation pressure) perturbations of satellites' orbits around the Earth, the Moon, and other solar system planets.
The candidate will spend his time in the Technion learning how to apply theoretical results from Lagrangian/Hamiltonian mechanics to practical orbit prediction of satellites. Alternatively, studying general perturbation models for nonlinear dynamical systems could also be one interesting (and less restrictive) topic.

Requirements/prerequisites: solid knowledge of Calculus, Differential Equations and Linear Algebra, as well as Analytical Mechanics (emphasis on Hamiltonian systems). Differential Geometry would be a major plus.
Candidates without knowledge of Analytical Mechanics could also fit, if they have decent knowledge in Nonlinear Vibration Theory or differential Geometry/Partial differential Equations/functional analysis. Candidates may be from Aerospace or Mechanical Engineering, Physics or Mathematics Departments/Faculties.
Required software fluency: Matlab or Python. Basic knowledge of a symbolic computation software (i.e. Maple or Mathematica) would be a major plus.

Igal Gluzman

igal.gluzman@technion.ac.il

The Fluid Mechanical Laboratory (FMLab) was founded in 2022 with the goal to enable advanced understating of complex problems in fluid mechanics. The research in the lab employs experimental, numerical, and theoretical methodologies that combine interdisciplinary approaches from dynamical systems, advanced signal processing, computer vision tools, and estimation theory.

FMLab is currently focused on the following research areas:

1. Transitional and turbulent boundary layers
2. Cavitation and bubble dynamics

Multiple research topics are available for motivated Strong Undergrad, M.Sc., and Ph.D. students.

The list of projects includes:

1. Low-Speed wind tunnel design.
2. Modeling of complex plasma actuation modalities in transitional shear flows.
3. Model-driven active flow control of wall-bounded turbulent and separated shear flows.
4. Blind disturbance separation in late stages of transition and fully developed turbulent flows.
5. Shock wave emission generation and evolution mechanisms in cavitating liquids.
6. Bubble dynamics of non-spherical cavities.
7. Stratified turbulence.
8. Flow visualization and diagnostic techniques.
9. Develop Computer vision algorithms for the study of single bubble breakup dynamics.

For more details, see:

https://aerospace.technion.ac.il/wp-content/uploads/2022/10/FML_Igal-Gluzman_2022.pdf

Minimum Qualifications:

1. Experience in CAD design (SolidWorks)
2. Background CFD simulations on CAD models.
3. High score in fundamental fluid mechanics courses (grades above 85).
4. Proficiency in MATLAB or Python.

Preferences:

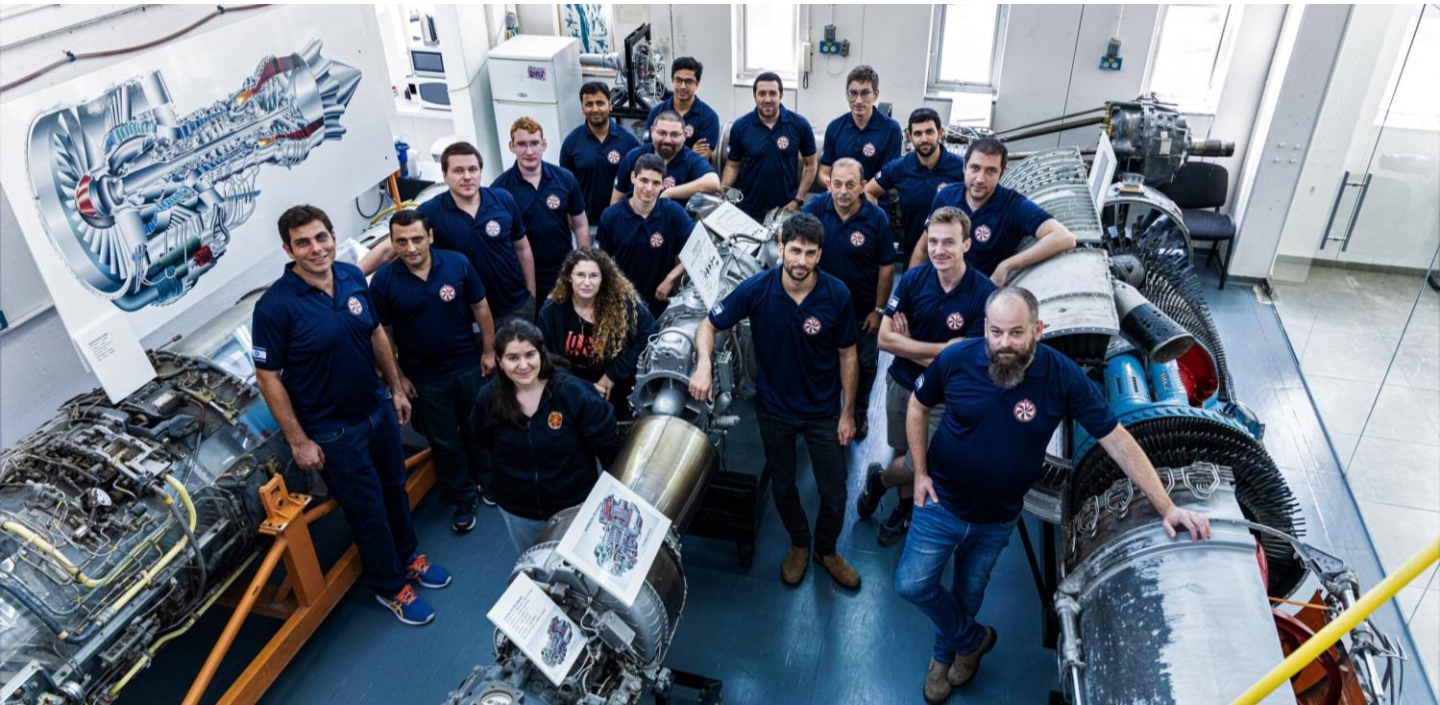
1. Background working with Computer Vision Toolbox in MATLAB or OpenCV modules.
2. Background in estimation and control theory.
3. Background in multiphase flows and cavitation.
4. Proficiency with experimental fluid dynamic techniques, and preferably experience working with Stereo PIV imaging, hotwire anemometry, pressure gauges, and thermocouples.

Beni Cukurel

bcukurel@technion.ac.il

Our laboratory conducts cutting-edge research and advanced development in the field of gas turbines for propulsion and power generation applications. The lab focuses its efforts on the hot gas section, consisting of the combustor and the turbine. The scientific contributions are primarily applicable towards small scale engines, which are commonly used in distributed power generation, business jets, unmanned air vehicles, auxiliary power units, marine systems and other applications. In light of more stringent emission requirements, demand for increased power-to-weight ratio, the progressively augmenting durability requisites, and critical necessity to improve cycle efficiency, the laboratory develops technology at the frontiers of the current knowledge with advances in Gas Turbine Component Design and Analysis, Basic and Applied Heat Transfer, Measurement Techniques Development. Further information can be found via the laboratory website at http://bcukurel.net.Technion.ac.il/.

Background:
Final year students with a strong background in any of the following: MATLAB, Solidworks / Creo, LabVIEW, Computational Fluid Dynamics, Finite Elements / Volumes Solvers.

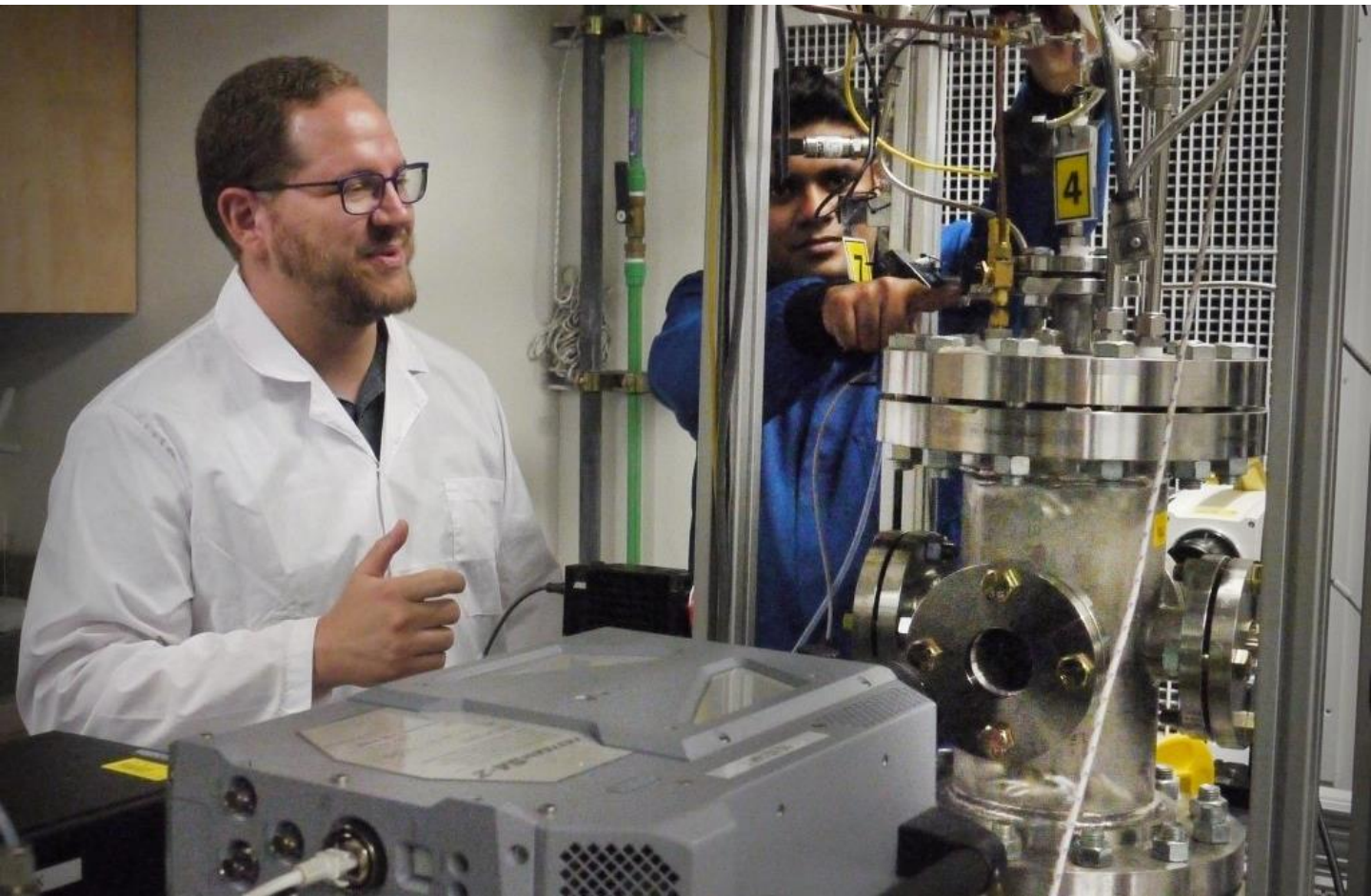


Joe Lefkowitz

joseph.lef@technion.ac.il

Multiple projects on the use of the zero-carbon alternative fuel, ammonia. Projects include the combustion of ammonia in a porous media combustor, reforming of ammonia using plasma discharges, ignition of ammonia in a flowing mixture, and diagnostics for ammonia combustion.

Background:
Students after their 2nd or 3rd year of study, with a background in thermodynamics, fluid mechanics, heat transfer, chemical reactors, or optics (all optional). Aerospace engineering, mechanical engineering, chemical engineering, or physics are all welcome.



Dan Zelazo
dzelazo@technion.ac.il

"Coordination and Control of Multi-Agent Systems - The cooperative networks and controls lab (Connect Lab) explores problems related to the coordination and control of multi-agent systems. Our scientific approach is to explore how the mathematical field of graph theory can interface with dynamic systems and control theory in the study of these systems. We are currently focused on three core projects: i) analysis and design of networked systems, ii) formation control and multi-robot coordination, and iii) distributed power generation and the smart-grid. We focus on fundamental theory while also exploring implementation challenges on a multi-robot testbed as a demonstrator. "

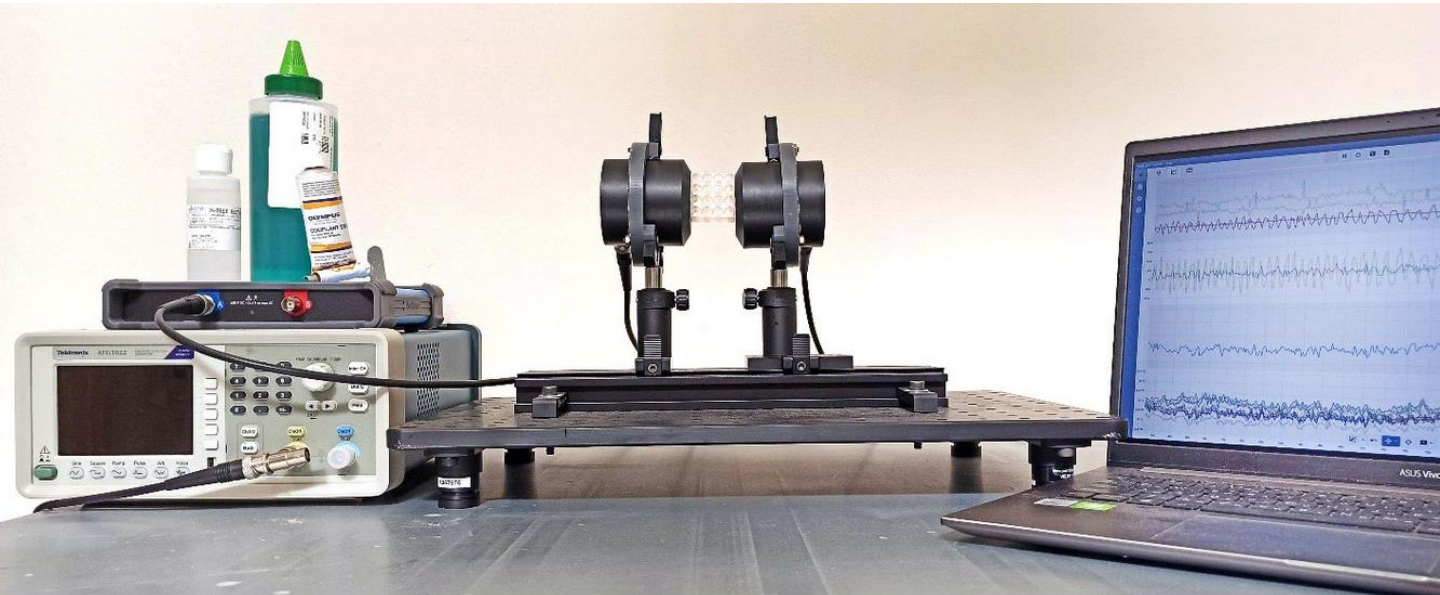
Background:
Students with strong fundamentals in dynamic systems, control theory, and mathematics. Experience with MATLAB/Simulink a requirement. Experience with robotic platforms and ROS also useful.

Pavel Galich

galich.pi@technion.ac.il

Numerical and experimental lab focused on elastic-wave mechanics, acoustic metamaterials, phononic crystals, nonlinear mechanics, magnetoelastic materials, and passive non-Hermitian acoustics. We develop novel lightweight materials and structures for protection from undesirable vibrations and noise in the Aerospace Industry. We perform transmission loss measurements for longitudinal [pressure] and transverse [shear] waves for a wide range of ultrasonic frequencies (i.e. 0.02-5 MHz); also, we determine sound absorption coefficient, surface impedance, and transmission loss, according to ISO or ASTM for a wide range of frequencies (i.e. 0.05–6.4 kHz)

Background:
Students should ideally have some knowledge in any of the following (or closely related): Wolfram Mathematica, COMSOL, Solidworks, nTopology, Labview, ultrasonics, acoustics, crystallography, nonlinear mechanics, magnetism.



Ian Jacobi
ijacobi@technion.ac.il

Experimental lab focused on fluid mechanics, turbulence, drag reduction, flow control, bubble dynamics, particle dispersion. We perform flow diagnostics in a high speed water tunnel using particle-image velocimetry, along with other optical and mechanical measurement techniques.

Background:
Students should ideally have some background in any of the following: matlab, solidworks, labview, electronics, optics