# MECHANICAL ENGINEERING STUDENT SEMINAR

**Thursday, August 24 2023 at 11:30**, D. Dan and Betty Kahn Building, Auditorium 1.

## Endo-atmospheric Vector Guidance

Ram Massas

**Advisor: Prof. Shaul Gutman**

Unmanned aerial vehicles (UAVs) have become a critical asset for militaries worldwide due to their versatility. Guidance laws refer to the strategy used by an aircraft to intercept or evade another aircraft. "Vector Guidance" is one of the modern 3D guidance laws employed in pursuit-evasion conflicts within exo-atmospheric scenarios. In the present research we analyze a pursuit and evasion endo-atmospheric scenarios between a drone as the pursuer and a UAV as the evader. We extend the vector guidance strategy to cover the effect of the aerodynamic drag force. This new and improved guidance law will be referred to as the "Extended Vector Guidance". The aerodynamic drag acting on an aircraft is directly proportional to the velocity square. Additionally, it is influenced by a parameter known as the aerodynamic drag coefficient. This aerodynamic drag affects the maneuverability of an aircraft by imposing maximum speed. As a result, the difference in maneuver magnitude between the pursuer and evader remains constant in the exo-atmospheric environment and varies with time in the endo-atmospheric environment. Consequently, in the extended guidance law, we calculate the difference in maneuver magnitude by subtracting the norm of the aerodynamic drag force acting on each aircraft. This calculation is performed using the system's state vector. Therefore, in the time-to-go equation within the guidance law, the difference in maneuver magnitude between the pursuer and evader varies with time in a non-linear manner. To evaluate the real-world effectiveness of the Extended Vector Guidance, a series of simulations were conducted.

Note: the seminar will be given in Hebrew


Seminars Coordinator: Assoc. Prof. Matthew Suss.