הטכניון מכון טכנולוגי לישראל TECHNION Israel Institute of Technology

Faculty of Mechanical Engineering הפקולטה להנדסת מכונות

MECHANICAL ENGINEERING MSc SEMINAR (30 min.)

Thursday, November 5 2026 at 14:00-14:30, Lady Davis Building, Auditorium 250

High fidelity urban canopy flows with the use of synthetic turbulent generator

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Urban environments are characterized by complex flow phenomena due to interactions between buildings, streets, and other urban structures. Understanding turbulent flow within canopies is essential, as it plays a pivotal role in the transport of heat, moisture, and gases between the atmosphere and the canopy. The complex dynamics of these canopy flows is essential not only for scientific discoveries, but also for addressing practical challenges in agriculture, urban planning, and climate change mitigation. Numerical simulations are crucial tools for comprehending these flows and their implications for urban planning and environmental assessments. In this study, we use the open-source solver PyFR which is based on Flux Reconstruction for Computational Fluid Dynamics (CFD) to carry out high fidelity Implicit Large Eddy Simulations (ILES) in order to investigate turbulent characteristics within an urban-like canopy. Simulations were conducted for two case studies of flows which characterized by Reynolds numbers of Re = 6800 and Re = 8000 for two sizes of domains, 13h × 10h × 5h domain and 9h×8h×5h. Leveraging the power of an NVIDIA GPU cluster, this research aims to enhance computational performance, allowing for more detailed and accurate simulations of turbulent urban flows. The flow characteristics observed in the present study indicate that the inlet flow, generated using an artificial turbulence method based on fictitious eddies, successfully reproduces the key turbulent properties measured in wind tunnel experiments within the roughness sublayer of the canopy structures. As a preceding stage of the research, simulations of turbulent flow around a single-height building are currently being performed with Re = 680000. The simulations aim to focus on characterizing the aerodynamic loading on the building, with particular emphasis on the pressure coefficient distribution over its surfaces and its relevance to structural and architectural design. The exact boundary layer, Reynolds stresses, and length scales are characterized by the inlet turbulent generator in order to mimic the exact measurements of the wind tunnel experiments. The simulations are used to investigate the flow and pressure characteristics around the building and to establish a high-fidelity reference for the subsequent development of realistic turbulent inflow conditions for urban simulations.

Seminars Coordinator: Prof. Sefi Givli

Note: the seminar will be given in English