הפקולטה להנדסת מכונות
Faculty of Mechanical Engineering

TECHNION Israel Institute of Technology
הטכניון מכון טכנולוגי לישראל

SEMINAR - סמינר

הנך מוזמן/ת להרצאה סמינריונית של הפקולטה להנדסת מכונות, שתתקיים ביום ב' 07.02.2022
(ו' באדר א' תשפ"ב), בשעה 14:30 סמינר יתקיים באוד' 6, קומה 0, בנין ד. דן ובטי קאהן.

מרצה:

Dr. Meital Geva
School of Mechanical Engineering,
Tel-Aviv University
meitalgeva@mail.tau.ac.il

על הנושא:

Towards a solution of an ancient problem: how does the wind create waves?

The seminar will be delivered in English

להלן תקציר ההרצאה:

Waves excited by wind fascinated human minds from early times. Today, research on generation of waves by wind is motivated by the increased interest in weather, climate and ocean ecosystem; all strongly depend on mass, momentum and energy transfer at the air-water interface. Nevertheless, the physics of excitation of waves by wind is not yet fully understood. Two major breakthrough-studies published in 1957 attributed wave generation to very different mechanisms: deterministic inviscid shear flow instability (Miles), and stochastic interactions between wave and turbulent pressure fluctuations in airflow (Phillips). Nonlinear theories were developed starting from 60's (Hasselmann, Zakharov). However, no quantitative experimental verifications of all those models exist. There is no theoretical explanation of the whole process of waves' evolution from initially quiescent water surface to finite steady state under impulsively applied wind forcing. All models assume spatial homogeneity, whereas in reality the amplitudes and the lengths of wind-waves increase with distance. Our study takes advantage of extensive experimental data accumulated in TAU Wave Laboratory on spatially and temporally varying wind-waves. This information enabled us to offer a fundamentally different physical approach that combines viscous shear flow instability, successive breaking of short components, finite wave propagation duration and the random character of wind-waves. The theory enables for the first time description of wind-wave evolution in time and in space. A general framework is formulated that offers theoretical explanation of the complex multistage evolution process observed in experiments. This framework may serve as a trigger for numerous detailed studies; some of those studies are now in progress. Specifically, we investigated the coupling between the turbulent airflow in the boundary layer above the spatially varying wavy-water surface. We show that the developing turbulent boundary layer over young wind-waves evolving under steady wind forcing preserves wall similarity and satisfies fully rough flow conditions. We demonstrate that the momentum deficit in the airflow boundary layer can be directly related to the water surface evolution.

About the presenter

Dr. Meital Geva is a postdoctoral research associate at the School of Mechanical Engineering at Tel-Aviv University (2020-present, hosted by Prof. Shemer). She earned her direct track Ph.D. at the ME Dept. at the Ben-Gurion University. She obtained 18 distinguished awards in the course of her academic studies. Upon graduation, she gained industrial experience at Soreq Nuclear Research Center as a thermo-hydraulic researcher. Her research interests include high-speed compressible flows, reactive compressible flows, thermo-hydraulic systems. Currently she focuses on wind-wave interactions, two-phase interfacial instability and turbulent boundary layers over rough surfaces. Her research is aimed at a better understanding of physics of various processes by theoretical and numerical analysis based on available experimental data.

מארח : פרופ' אולג גנדלמן

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