



Mechanical Engineering Seminar

Monday, April, 1, 2024 at 14:30, D. Dan and Betty Kahn Building, Room 217

Blue Economy Engineering

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Hosted by: Prof. Wolf Alon

The World Bank defines **Blue Economy** as the Sustainable use of ocean resources for economic growth and improved livelihoods, while preserving the health of ocean ecosystem. The ocean is a random and hostile environment. Sustainable development of large and innovative marine facilities requires conceptual design, applying the most advanced engineering tools in all approaches: analytical, numerical, model experiments and sea trials. The development combines structural analysis and hydrodynamics that are integrated into the design by the basics of the core courses of our faculty: Solids and Fluids Mechanics, Dynamics, Engineering Materials, Design and Analysis.

I will present three research projects, of which two are already operated successfully at open sea, while the third is very ambitious and is still a vision. Common to all is "Blue Economy Engineering". The projects develop three aspects to harness the open sea as a living area: **Paving the Ocean - Transportation - Aquaculture**. In the aspect of Marine Transportation, the common concept of fast boats is Planing. The hull design of a planing boat is governed by slamming loads, which are extreme and violent. Many studies in the last three decades deal with the query of importance of hydro-elasticity for design, however no practical design method that consider hydro-elasticity has been published. In our study (MEYMD program) "**Design of fast boats considering hydro-elasticity**" we present such a process, first with the Allowable Stress Design (ASD) philosophy and later with the Fatigue Limit State (FLS) design philosophy. We designed and constructed a research boat according to our method and performed a series of sea trials that validated our new design method and showed the potential to reduce 30% of the hull weight. In the field of **Aquaculture**, for the last three decades, development efforts are made to expose fish farms from protected waters to the open sea. In the "**Ocean-Fish**" research (Horizon 2020) we developed a new concept of fish farm, performed hydro-elastic analysis, designed and constructed a prototype that was launched and operated during the study and successfully operated six years. Probably this fish farm combines the world's highest growth volume with most exposed sea conditions. In the aspect of "**Paving the Ocean**", we developed a new concept of **VLFS (very Large Floating Structure)**, which forms a floating harbor that is needed for its efficient utilization. In a research for the Israeli Ports Company, a feasibility study was carried out that comprises hydrodynamic analysis, global structural analysis, design and cost estimate. The results encourage further development. This development is ambitious and groundbreaking and is still a vision.