PHYSICAL MATHEMATICS SEMINAR

On gravity and gravity-capillary water waves and current

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ABSTRACT:

Mankind relies on natural and man-made bodies of water for habitation, transportation, recreation, energy and sustenance. Wave and current motion are two dominant features of sea surface hydrodynamics. The modeling, measurement and prediction of waves is a routine task for marine engineers and oceanographers. In contrast, it is less routine to account for current effects on waves. Yet, such effects are of known importance to the design of coastal and offshore structures, sediment transport, coastal morphology, and naval architecture.

The following work addresses (i) novel physical effects of current on surface water waves and (ii) a non-trivial relationship between wave dispersion, current and viewer velocities (e.g. velocity of measurement). The former arise in theoretical analyses using a multi-valued form of the wave-current dispersion relation. This dispersion relation is well known. However, it is mostly ignored in the literature in favor of simpler single-valued forms. This simplification is shown to have left important gaps with respect to nonlinear interactions, resonance and "Wilton's ripples". The neglect of a subset of dispersion solutions has been justified by some using arguments of Galilean invariance. Whereas, it is shown that the water wave problem is not, strictly speaking, Galilean covariant. This leads to a discussion regarding the relationship between mathematical descriptions given by different inertial viewers, of relevance to modern marine measurement instrumentations which often move with different velocities and directions relative to current and waves.

TUESDAY, OCTOBER 12, 2021
2:30 PM – 3:30 PM
Building 2, Room 449

https://math.mit.edu/sites/pms/

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- **remember to keep your mask on while inside buildings**
- **eating food is not allowed within lecture rooms**

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