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Name: **Dr. Ayan Chandra (Principal Investigator)**

Department: **Mathematics**

Project Title: **Mitigation of resonant wave sloshing in confined basins: a multiple scale analysis**

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Fund Utilised.: 0

Tenure: **5 Years**

Abstract:

In many industries, such as the transport of liquid cargo, submerged structures are used to mitigate hazardous side-to-side sloshing of a liquid in an accelerating, vibrating or pitching tank. The effectiveness of these structures depends on their orientation and size relative to the liquid depth. We demonstrate, however, that some structures may excite resonant triads, a form of collective interaction between three wave modes that drives sustained large-amplitude sloshing. We combine asymptotic analysis and numerical computation to characterise the class of vertical and horizontal structures that excite triads in a stationary rectangular tank, paying particular attention to the relative time scale of the triad interaction. For vertical structures, we rationalise the onset of triads by considering the limit in which the submerged structure is of maximal height, and identify structure placements at which the triad interaction time scale diverges. Our study highlights a new mechanism for exciting resonant triads of gravity waves in confined basins. The purpose of this research is to develop a novel and systematic framework for mitigating hazardous sloshing in industrial and geophysical basins. Sloshing thus represents a severe hazard, inducing flooding and unsafe motion of tankers transporting liquid cargo. The primary challenges for mitigating sloshing involve quantifying its severity for different basin geometries and characterising its dependence on the vibration or motion of the confining vessel and the excitation of internal resonances. The theoretical developments will be buttressed by numerical investigations and larger-scale investigations using industrial and field data.