Abstract Submitted
for the DFD20 Meeting of
The American Physical Society

Air cushioning and impact pressures during a wedge slamming on water[1] UTKARSH JAIN, Univ of Twente, VLADIMIR NOVAKOVIC, HANNES BOGAERT, Maritime Research Institute (MARIN), The Netherlands, DEVARAJ VAN DER MEER, Univ of Twente — The water entry of a wedge has become a model test in marine and naval engineering research. Wagner theory, originating in 1932, predicts impact pressures, and accounts for contributions to the total pressure arising from various flow domains in the vicinity of the wetting region on the wedge. Here we study the slamming of a wedge and a cone with a deadrise angle of 10 degrees. Using a linear motor, a constant, well-controlled velocity is maintained throughout the impact event. Using an in-house visualisation technique, we reveal that air-cushioning under the cone causes a significant deflection of the water surface prior to impact. Pressures at two locations on the impactor are measured during and after impact. Pressure time-series from the two impactors are discussed using appropriate hydrodynamic pressure, and inertial time scales. The non-dimensionalised pressure time series are compared to composite Wagner solutions (Zhao Faltinsen 1993). It is shown that, without a single free parameter, the space-averaged composite solutions reproduce the measurements near perfectly well, and a finite size of the sensor is why the peak pressure has a non-singular rise. Approximations made in the inner-domain for extending the Wagner model to three-dimensions are experimentally justified.

[1]We acknowledge financial support from SLING (project number P14-10.1), which is partly financed by the Netherlands Organisation for Scientific Research (NWO).

Utkarsh Jain
Univ of Twente

Date submitted: 03 Aug 2020 Electronic form version 1.4