

Dynamic Instability and Fluid Interaction in Underwater Structures Under Complex Loading Conditions

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This talk will present recent experimental results on the dynamic collapse of designed composite cylinders under complex loading conditions. Experiments are conducted to study the mechanics of implosion of single hull and double hull structures with and without confining conditions. Experiments are also performed to investigate sympathetic implosions and interaction of an imploding cylinder with a nearby structure. State of the art pressure vessel facilities are used to study the implosion process. These pressure vessels are outfitted with several windows to allow the use of the 3D Digital Image Correlation (DIC) technique. The pressure histories generated by the implosion event are captured from dynamic pressure transducers mounted close to the specimen in all the experiments. These pressure histories are then related to real time deformations and velocities occurring on the shells. High speed images are captured for better understanding of the deformation mechanisms and collapse modes of the structures during the experiments. 3D-DIC technique is utilized in conjunction with high speed photography to get quantitative information on the deformation of the collapsing cylinders. Displacements, velocities, and variations in the pressure profile are correlated to key stages of the collapse event to improve understanding of the failure process during the implosion of underwater structures.