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Experimental study for water impact of composite panels

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Abstract

To improve aircraft safety during an emergency landing on water, it is important to have a good knowledge of the structural behavior. However, the structural analysis during water impact is always challenging as the complex fluid-structure interaction phenomenon is involved.

This research aims to analyze composite panels during water impact and to evaluate the damage, if any. The presented work focuses on the test setup and test results for water impact of the composite panels.

The panels, manufactured at the Delft University of Technology, are made of AS4/8552 carbon epoxy composite material. They have a stacking sequence of $[45,0,-45,90]_{4s}$, resulting in a total thickness of 5.94 mm. The length and width are both 400 mm. A steel frame of 16 kg is added on the top of the panels.

During the water impact tests, conducted at Politecnico di Milano, the composite panels were released from different drop heights and impacted into a water basin. Two high-speed cameras were set on two sides to capture the impact moment and the panel's deformation. The structural response of the composite panels was sampled in terms of accelerations, strains and pressures measured at selected locations. The test setup and the test structure with instrumentation are shown in Figure 1.

The acceleration curves of a test from a 3-meter height impact are shown in Figure 2. The three acceleration curves are from the three accelerometers located on the steel frame. The panel resulted slightly tilted during the drop, since two accelerometers have higher peak values than the third accelerometer. The strain curves measured from the strain gauge installed in the center of the panel are shown in Figure 3. The x-direction and y-direction strains are slightly different due to the layups of the panel.

The complete test results will be presented at the conference.

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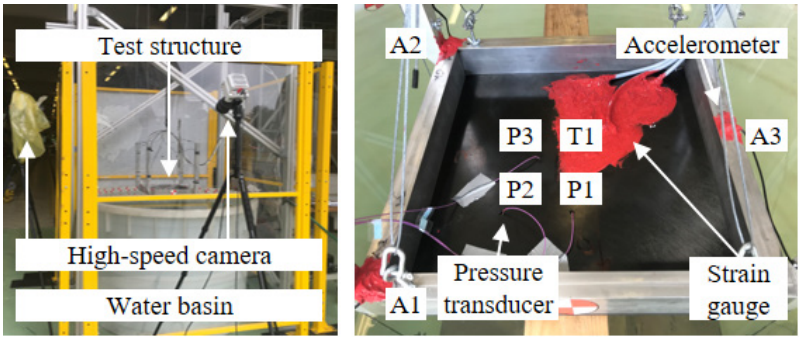

Figure 1: Test setup and test structure with instrumentations.

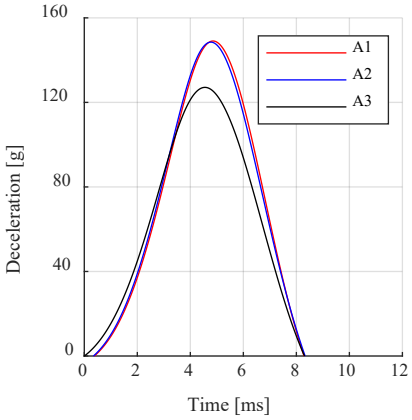

Figure 2: Deceleration curves measured during a 3-meter height water impact.

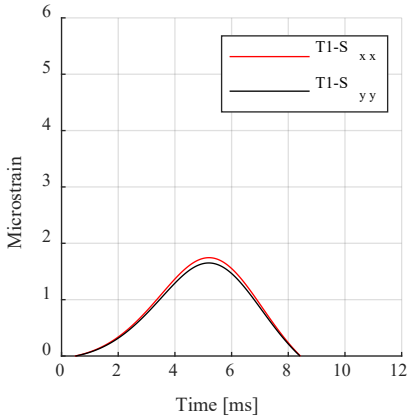

Figure 3: Strain curves measured during a 3-meter height water impact.

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