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Dynamic and Impact Response of Materials and Structures

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Summary

This key-note lecture is a contribution to: ICCES'11 SPECIAL SYMPOSIUM ON MODERN EXPERIMENTAL METHODS IN MECHANICS, ENGINEERING, AND THE SCIENCES (Organizing Committee Co-Chairs: Fu-Pen Chiang (USA), YiIan Kang (China), Huimin Xie (China), Xiaoyuan He (China))

Presented, in this keynote lecture, are experimental data relating to composite sandwich materials subjected to different rates of loading including explosive blast. The composite sandwich materials are manufactured using a variety of different skin and core materials. Experimental results are described for quasi-static, high-rate and explosive blast loading using DIC to identify failures processes.

An important benefit of composite sandwich materials is their high strength to weight ratio. This has led to their increasing use in marine and aerospace applications. Identifying the damage tolerance of existing and new sandwich constructions is needed in evaluating their retention of mechanical properties after impact or other inflicted damage.

One example shown is a composite sandwich panel extracted from an offshore wind turbine blade. The redistribution of strain, from the onset of damage e.g. core shear fracture, and its subsequent development is in evidence by DIC and this has been modelled using FEA.

Another example, for a marine application, is a composite sandwich material subject to explosive air blast (30 kg of explosive (C4) at different stand offs). Back face imaging and DIC allowed for deformed contour plots to be made and identification of core cracking and front skin failure during the blast event. Also, these processes have been modelled using FEA.

Continuing research studies are addressing structural integrity, blast and other high loading conditions.

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