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AN EXPERIMENTAL AND NUMERICAL STUDY ON THE DYNAMIC BUCKLING OF CYLINDRICAL COMPOSITE SHELLS

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The present investigation focuses on the dynamic effects associated with load speed versus the buckling behavior of axially compressed cylinders.

Several glass, aramid, and carbon fiber-reinforced plastic cylindrical specimens have been produced for experimental validation. The production method was cylindrical winding with vacuum resin impregnation. All the specimens produced had a length of 850 mm and inner diameter of approximately 300 mm. The production technology required that the testing specimens be slightly conical, so the inner diameter varied along the specimen length. The specimens were loaded quasi-statically up to the post-buckling region (see Fig. 1) to evaluate the buckling load and the post-buckling behavior under static loading. Then, the axial loading was repeated, gradually increasing the loading speed up to 0.15 m/s, with registrating the load–shortening curves. A nondestructive vibration testing was performed before and after the loading tests to verify that no damage had occurred.

The numerical part represents the benchmarking of the commercially available

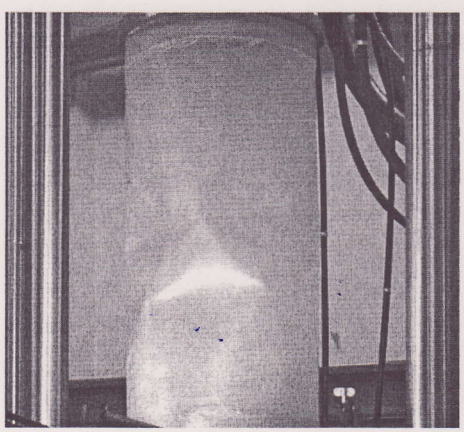

Fig. 1. The post-buckling shape of an axially compressed glass-fiber cylinder.

finite-element analysis software packages ABAQUS and ANSYS/LS-DYNA by using data obtained from the physical experiments. A procedure of optimum design is proposed.

REFERENCE

1. J. Singer, J. Arbocz, and T. Weller, "Buckling Experiments: Experimental Methods in Buckling of Thin Walled Structures," Vol. 2, J. Wiley & Sons, New York (2002), 1732 p.