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Buckling behavior of GFRP cylindrical shells subjected to axial compression load

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1. Introduction

The subject of buckling and post-buckling has a relatively short history for composite laminated shells in comparison with isotropic homogenous shells. Nevertheless, during this short time considerable research has taken place and a remarkable attention has been became to the stability of anisotropic shell. Numerous studies on the modeling and analysis of composite laminated cylindrical shells have been performed. However, the theories used in these analyses are mostly extensions of the various isotropic shell models. Recently, for the purpose of optimum design of composite laminated shell structures, fully anisotropic laminated cylindrical shells attracted more attention by Weaver, Wong and Weaver, Semenyuk and Trach and Takano. In composite laminated cylindrical shells, when the angles of fibers are not parallel in the cylindrical axis or not in the circumferential plane, the bending-twist and twist-extension couplings are presented. Hilburger et al. developed an analytical solution to predict buckling load of the composite cylinder with cutout. Smerdov (2000) presented a computational method in optimal formulation of optimization problems on laminated cylindrical shells under compressive axial loads. It is shown that, for most practical cases, there is no gain in increasing the number of the layers above four and the number of variable parameters above two. Weaver et al. (2002b) pointed out that, even for a quasi-isotropic laminated cylindrical shell consisting of 0, 90, +45/−45 plies, the minimum number of layers is 48 when extension-twist and flexural-twist couplings are vanished.

2. Experimental procedure

1. ***specimes***

This report explores buckling and post-buckling behavior of GFRP cylindrical shells subjected to axial compression load using experimental procedure. The effects of the L/R ratio on these shells are examined.

Table 1: Geometric Properties of Specimens

Specimen Name	Diameter(mm)	Length(mm)	Thickness of shell	Layer angles
CG10	200	100	2	Not defined
CG15	200	150	2	Not defined
CG20	200	200	2	Not defined

2. Test setup

In the laboratory the axial load was applied by a vertical hydraulic jack, the capacity of this jack is 600 KN which connected to a vertical column system consisting of four UPE18. The load is exerted by the jack to peak of truss that is located under jack. After applying load to peak of the truss, the force transmitted by the members of the truss to supports. A load cell is connected to end of the moving support, and one LVDT is mounted on the load cell thus the displacement is transferred directly to data logger.

Overall view of the loading system