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RECENT ENHANCEMENTS TO PANDA2 (computer program for minimum weight design of stiffened panels and shells)

David Bushnell, Lockheed Martin Palo Alto Research Lab., California

(This is an abridged version. See the full-length paper for more: panda2.papers/1996.enhance.pdf)

ABSTRACT

PANDA2 is a computer program for the minimum weight design of stiffened, composite, flat or cylindrical, perfect or imperfect panels and shells subjected to multiple sets of combined in-plane loads, normal pressure, edge moments, and temperature. The panels can be locally postbuckled. Recent additions to PANDA2 include implementation of: Sanders-type shell equations as a user-specified choice in addition to the Donnell equations, a 'global' optimizer processor, SUPEROPT, which in a single long run finds optimum designs from several different starting designs, and Arbocz' (1993) extension of Koiter's (1963) special theory for computation of buckling load factors for perfect anisotropic cylindrical shells and knockdown factors for axisymmetrically imperfect shells. Also incorporated are the ability to handle a new truss-core sandwich configuration and isogrid-stiffened panels and shells. These extension to PANDA2 are described and examples are given.

INTRODUCTION

Previous work on PANDA2 is documented in [1-7]. PANDA2 incorporates the theories of earlier codes PANDA [8] and BOSOR4 [9]. The optimizer used in PANDA2 is called ADS [10]. Included among the PANDA2 processors is a processor called STAGSMODEL that generates input files for use with the STAGS computer program [11-14], a general purpose structural analysis code with sophisticated nonlinear continuation algorithms [15-18]. Therefore, STAGS can be used with reasonable ease to evaluate panels that have been designed with PANDA2. (2011 NOTE: PANDA2 now also has a new and improved processor called STAGSUNIT that generates input files for use with STAGS in cases in which their exist both stringers and rings, as well as for cases that include only stringers or only rings.) A significant portion of the PANDA2 coding is dedicated to finding post-locally buckled equilibrium states [4], Optimum designs of stiffened panels with locally postbuckled skin can therefore be obtained with PANDA2. Other codes that have this capability are described in [19-22]. References to other work in the field of stiffened panel test, analysis, and design are included in earlier papers [1-5].

The purpose of this paper is to describe the five enhancements to PANDA2 listed in the abstract and to provide examples for each.

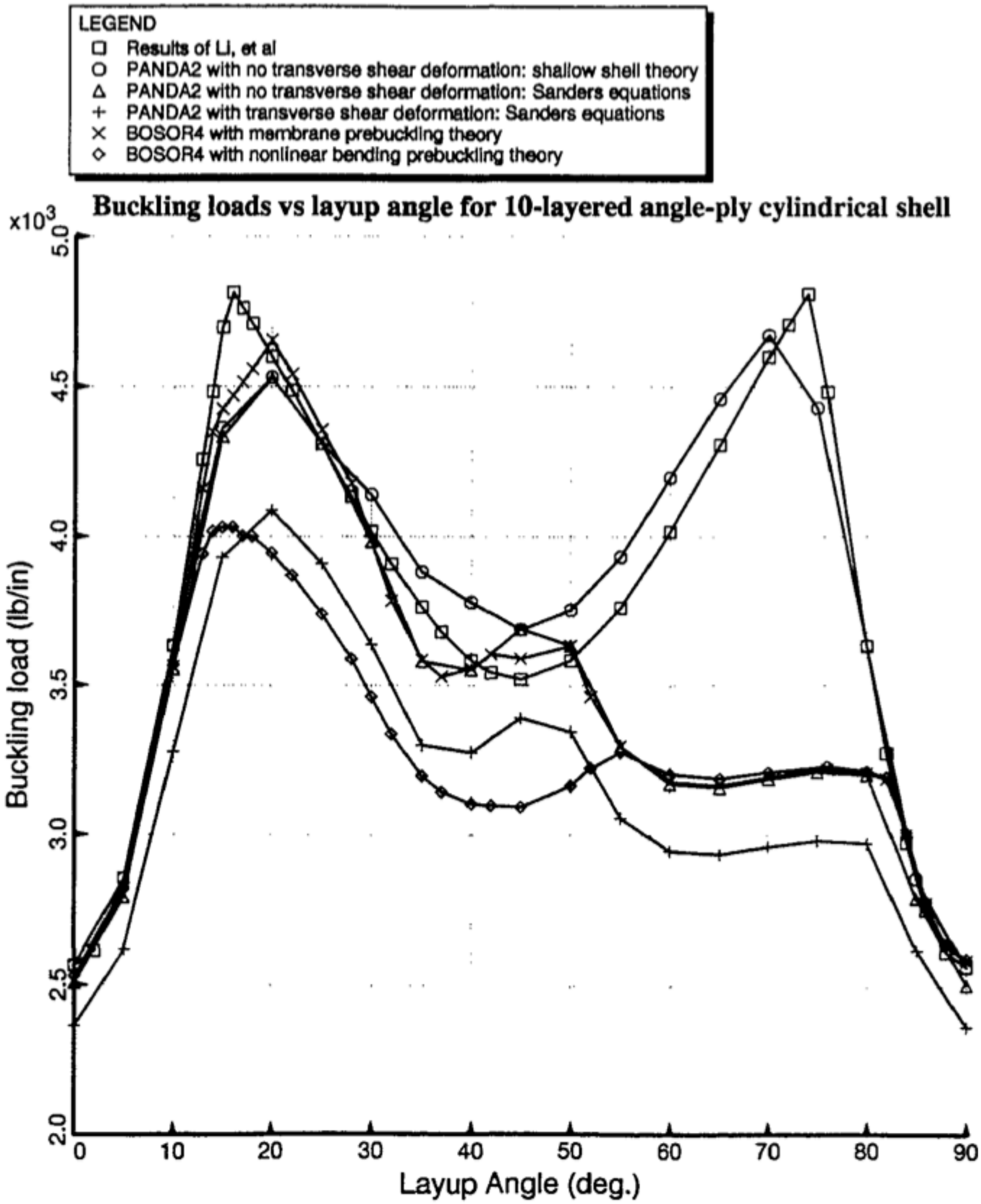

Fig. 1 Buckling loads for an axially compressed, 10-layered, angle-ply composite cylindrical shell. (From the AIAA 37th Structures, Structural Dynamics, and Materials Conference, Salt Lake City, UT, 1996, pp. 126-182)

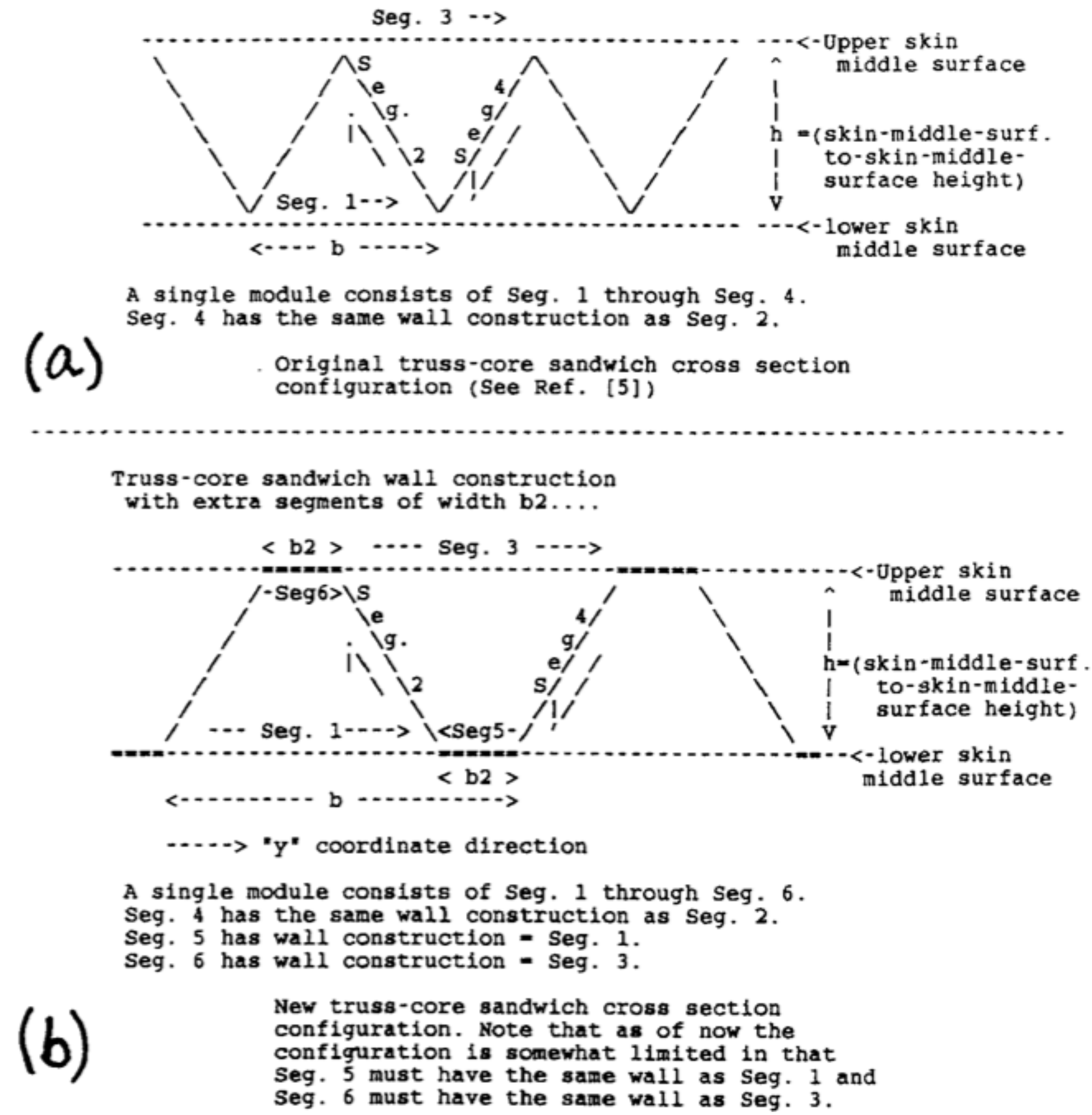

Fig. 9 (a) Original truss-core cross-section geometry; (b) New alternative geometry permitted in PANDA2. (From the AIAA 37th Structures, Structural Dynamics, and Materials Conference, Salt Lake City, UT, 1996, pp. 126-182)

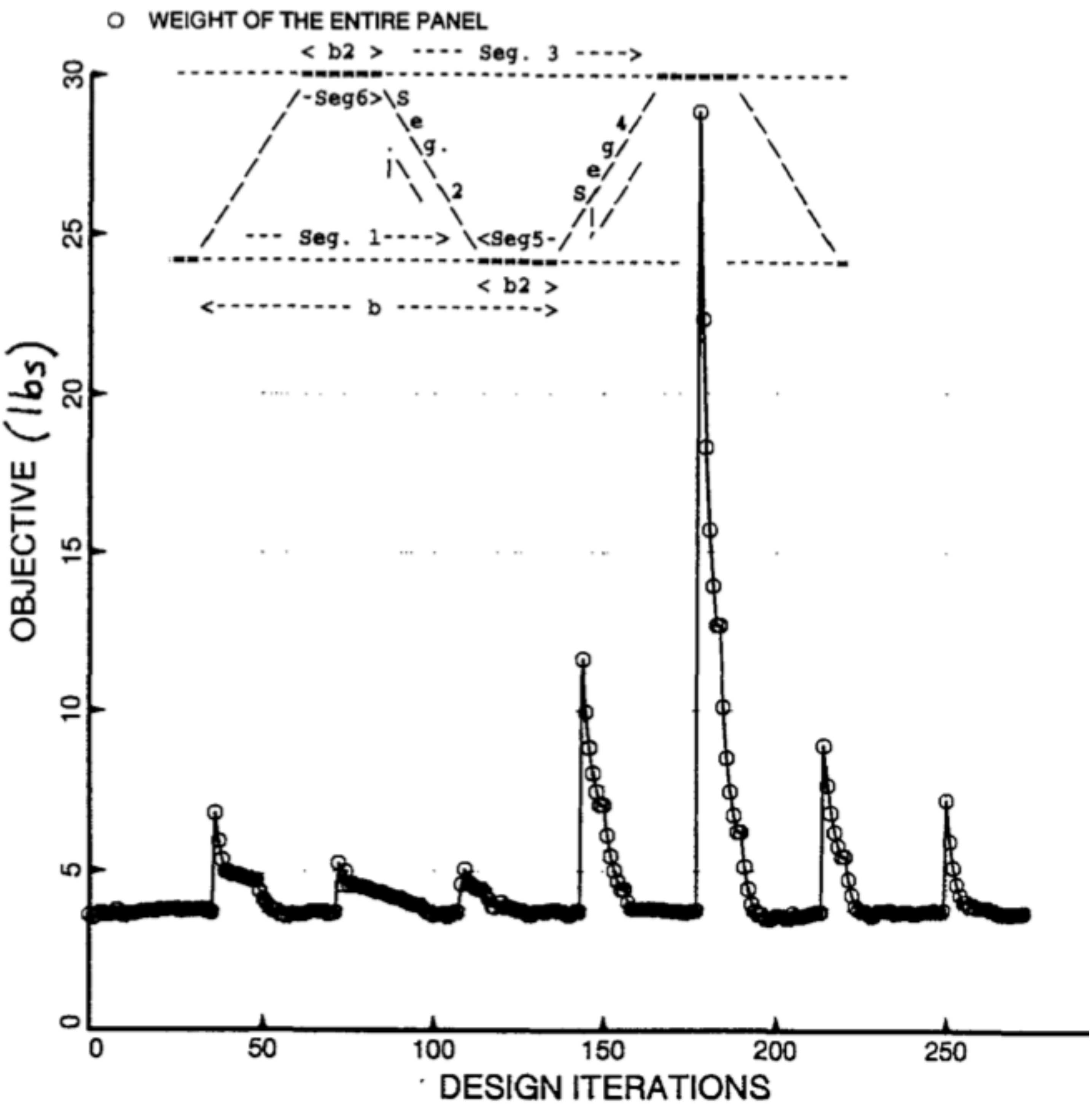

Fig. 13 Weight of the panel during execution of SUPEROPT for the truss-core panel with the new cross-section geometry. (From the AIAA 37th Structures, Structural Dynamics, and Materials Conference, Salt Lake City, UT, 1996, pp. 126-182)

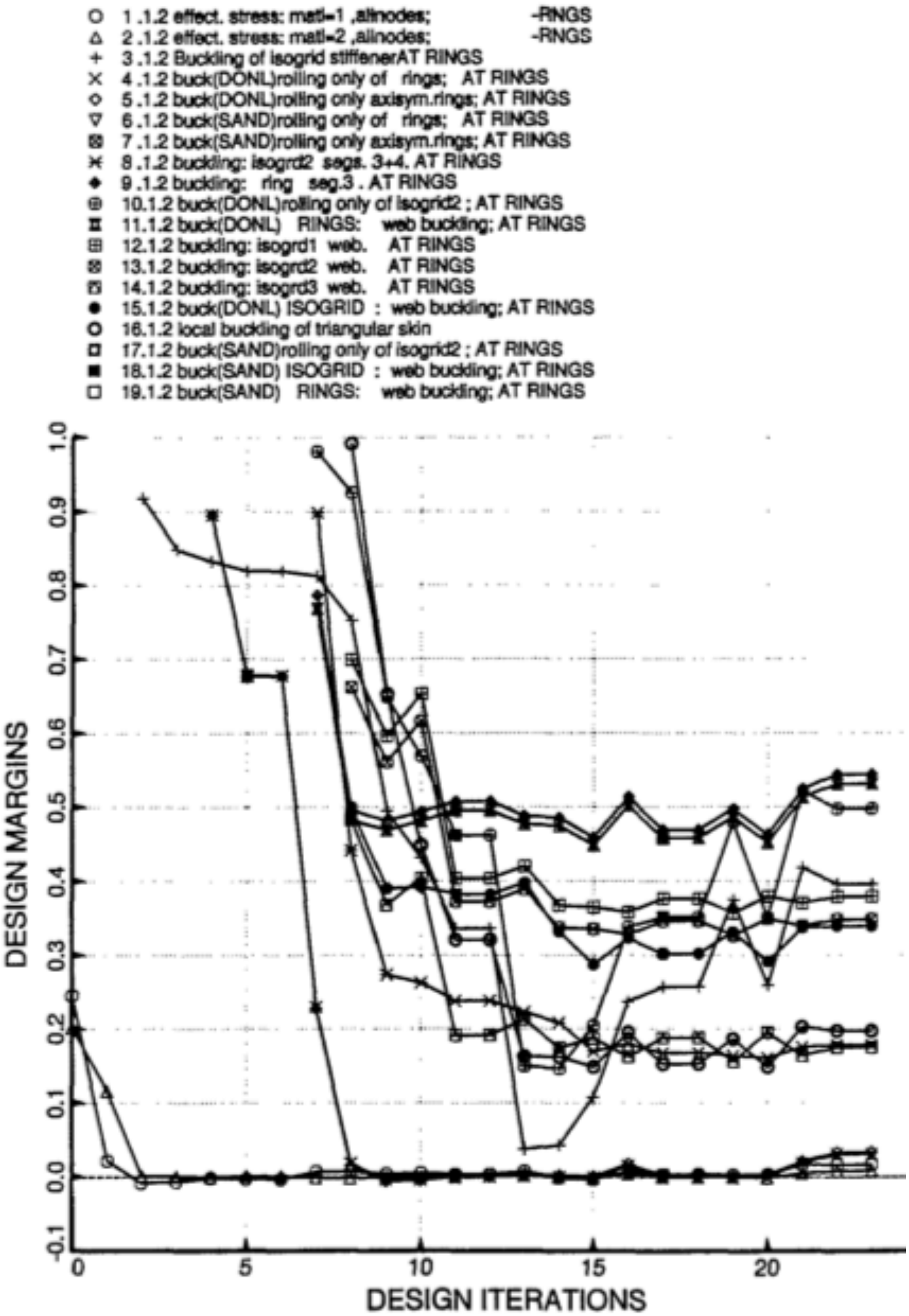

Fig. 40 Optimization of hydrostatically compressed isogrid and ring-stiffened perfect cylindrical shell. The margins correspond to conditions at ring stations (Subcase 2). (From the AIAA 37th Structures, Structural Dynamics, and Materials Conference, Salt Lake City, UT, 1996, pp. 126-182)

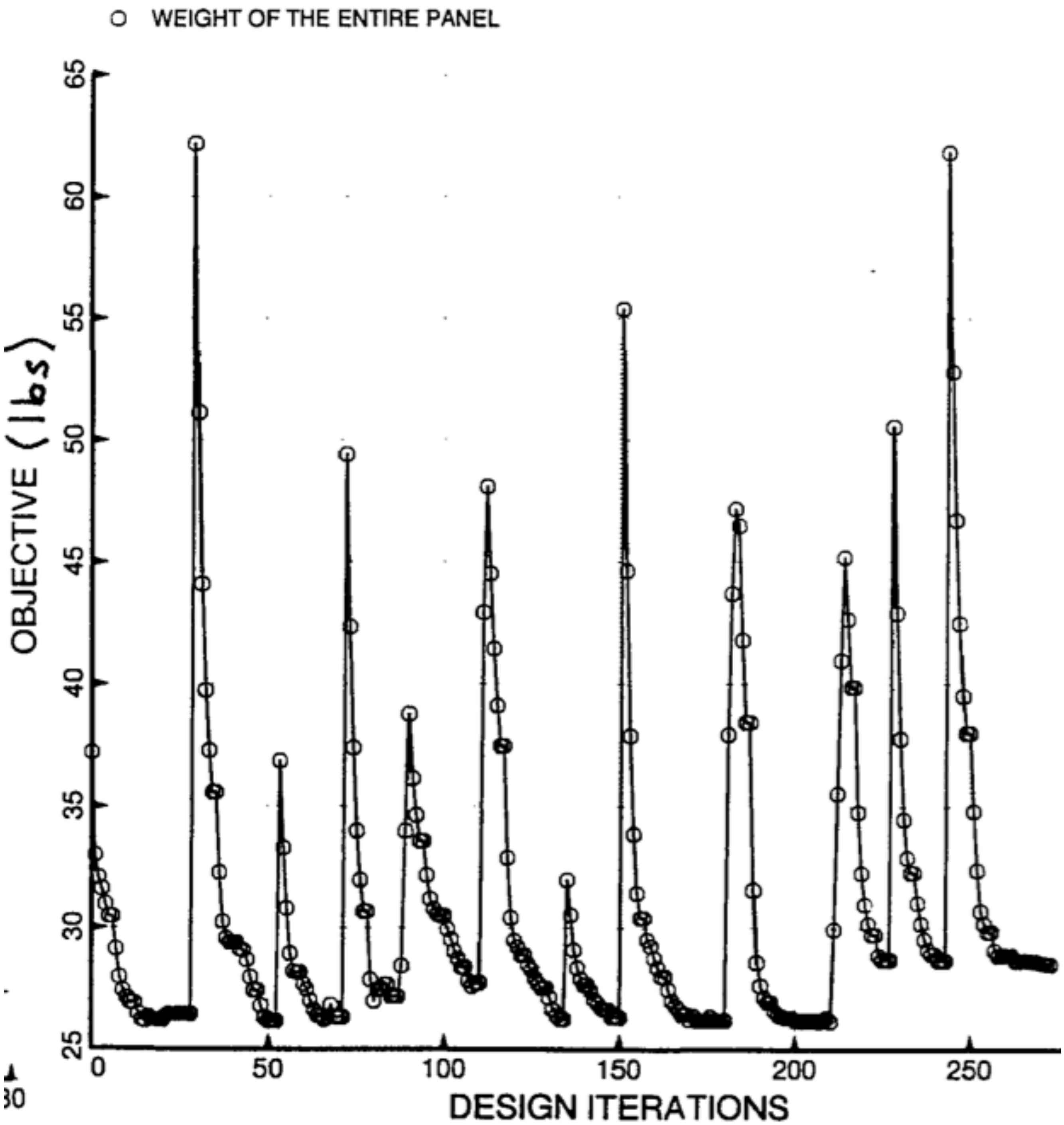

Fig. 43 Optimization via SUPEROPT of a hydrostatically compressed isogrid and ring-stiffened perfect cylindrical shell. These results are from the “two-materials” model. Five PANDAOPTs per AUTOCHANGE were specified for the execution of SUPEROPT. (From the AIAA 37th Structures, Structural Dynamics, and Materials Conference, Salt Lake City, UT, 1996, pp. 126-182)