Journal of Applied Mechanics

Discussion

Buckling and Postbuckling of a Long-Hanging Elastic Column Due to a Bottom Load[1]

M. M. Bernitsas[2] and T. Kokkinis[2]. The results derived in the paper are valid in two cases:

(1) For columns for which one end can move freely laterally, i.e., an end that does not admit horizontal forces, and that have length greater than 10 bending lengths.

(2) For columns for which both ends are the same vertical line in the limit as their length approaches infinity.

However, in the second case the results are not applicable to columns of large finite length, which is the case of most practical applications. In this case the governing equation, corresponding to equation (4) in the paper, is inhomogeneous, because the column admits horizontal forces at both ends. Global equilibrium of the entire column in the deformed configuration proves this point. For this reason the convergence of the stability boundaries to those of a column of infinite length does not occur within 10 bending lengths. Actually it occurs within 1 percent for lengths greater than 10^{25} bending lengths.

Correct results for this case can be derived for all types of boundary conditions by quasi-asymphotic analysis of the solution to the inhomogeneous problem. The detailed mathematical derivation is in reference [1]. A summary is presented in reference [2].

References

1 Bernitsas, M. M., and Kokkinis, T., "Asymptotic Analysis of Riser Stability Boundaries," Department of Naval Architecture and Marine Engineering, The University of Michigan, Report #255, Nov. 1982.

2 Bernitsas, M. M., and Kokkinis, T., "Asymptotic Behavior of Column and Riser Stability Boundaries," submitted for publication to ASME Journal of Applied Mechanics.

Author's Closure

My paper investigated the case where the bottom load is free to move horizontally. Drs. Bernitsas and Kokkinis correctly stated the validity of my results. I have not studied the interesting case where both ends are always vertically aligned.

[1] By C. Y. Wang, and published in the June 1983 issue of ASME Journal of Applied Mechanics, Vol. 50, pp. 311–314.

[2] Department of Naval Architecture and Marine Engineering, North Campus, The University of Michigan, Ann Arbor, Mich. 48109.

An Analysis of Adhesive-Bonded Single-Lap Joints[1]

D. J. Allman[2]. I note that the paper by Chen and Cheng [1] develops an essentially indentical theory to my paper [2] published in the *Quarterly Journal of Mechanics and Applied Mathematics*, 1977. Although the latter paper is often referenced by British authors [3, 4], it seems to have not yet penetrated the American technical literature. The paper presents analytic solutions for a wide range of lap joints with very thin adhesive layers, rigid adherends, typical metal adherends, and typical composite adherends. It is also relevant to mention the finite element application of the theory to lap joints with dissimilar adherends which is described in reference [5].

References

1 Chen, D., and Cheng, S., "An Analysis of Adhesive-Bonded Single-Lap Joints," ASME Journal of Applied Mechanics, Vol. 50, 1983, pp. 109–115.

2 Allman, D. J., "A Theory for Elastic Stresses in Adhesive Bonded Lap Joints," *Quarterly Journal of Mechanics and Applied Mathematic*, Vol. XXX, 1977, pp. 415–436.

3 Wake, W. C., *Adhesion and the Formulation of Adhesives*, Applied Science, 1982.

4 Allen, K. W., ed., *Adhesion 4*, Applied Science, 1980.

5 Brooker, M. J., "The Stress Distribution in Adhesively Bonded Lap Joints," MSC Thesis, Department of Aeronautics, Imperial College of Science and Technology, 1980.

Authors' Closure

The authors wish to thank Dr. Allman for bringing his paper to their attention and express their regret for having overlooked his work.

We wish to mention, however, that the method of approach of the two papers is quite different despite the fact that both are based on essentially similar assumptions and that the resulting governing differential equations are also different. We feel the method used in our paper, which deals directly with the components of stress which is the main object of the analysis, is more direct and simple. In this way, a closed-form solution that is adaptable for any possible adhesive layer flexibility and capable of satisfying all the boundary stress conditions of the joint is obtained. To illustrate the application of the present unified theory and to examine the

[1] By Du Chen and Shun Cheng, and published in the March 1983 issue of the ASME Journal of Applied Mechanics, Vol. 50, pp. 109–115.

[2] Department of Materials and Structures, Royal Aircraft Establishment, Farnborough, Hants, England.