

Reply by Author to A. H. Flax

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AS remarked by Flax, the expressions derived by the author¹ for second-order sensitivities are limited to stiffness modifications for the conservative case. This is a consequence of the perturbation equation (3)¹

$$(\lambda \underline{A} + \underline{B}) \underline{x} = \epsilon \underline{Q} \underline{x}$$

where \underline{Q} is treated throughout as a constant perturbation matrix and cannot subsequently be treated as a function of λ .

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The extension of the analysis provided by Flax shows that for mass modifications an additional term enters the second-order perturbation. This would be of considerable significance if the second-order sensitivities were to be used in the synthesis of modified systems. The original paper¹ concerned itself specifically with the dangers of neglecting second-order sensitivities in system synthesis. In this respect, the work of Flax supports this, particularly his Eq. (8). A fuller treatment of this and similar problems may be found in Lancaster.²

Recent work by Tomita and Frohrib³ may lead to extrapolations similar to those implied by Vanhonacker,⁴ where second- and higher-order sensitivities are neglected in predicting effects due to design changes.

References

¹Brandon, J. A., "Derivation and Significance of Second-Order Modal Design Sensitivities," *AIAA Journal*, Vol. 22, May 1984, pp. 723-724.

²Lancaster, P., *Lambda Matrices and Vibrating Systems*, Pergamon, Press, New York, 1966.

³Tomita, K. and Frohrib, D. A., "Sensitivity Functions as Predictors of the Influence of Design Parameters on Frequency Response Properties," ASME Paper 83-DET-97, 1983.

⁴Vanhonacker, P., "An Introduction to Sensitivity Analysis," Sixth Modal Analysis Seminar, University of Leuven, Sept. 1981.

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