SIMPLIFIED ALGEBRAIC METHOD FOR COMPUTING EIGENPAIR SENSITIVITIES OF DAMPED SYSTEMS

Hong-Ki Jo[(1)], Sun-Kyu Park[(2)], and In-Won Lee[(3)]*

[(1)] Graduate Student, Department of Civil Engineering,
Korea Advanced Institute of Science and Technology, Taejon 305-701, Korea

[(2)] Professor, Department of Civil Engineering,
SungKyunKwan University, Suwon 440-746, Korea

[(3)]* Professor, Department of Civil Engineering,
Korea Advanced Institute of Science and Technology, Taejon 305-701, Korea

ABSTRACT

Variations in system parameters lead to changes in dynamic characteristics and hence in responses. The derivatives of the eigenpairs with respect to design parameters are useful in design trend studies and in gaining insight into the behavior of physical systems. Using these eigenpair derivatives in large systems can remarkably reduce the cost of reanalysis. In contrast to computing eigenvalue derivatives where preferred methods exist, there are a number of different methods for calculating eigenvector derivatives. The different methods seek to overcome the practical difficulty of solving a singular matrix equation.

Methods for calculating eigenvector derivatives include the finite-difference method, the iterative method, the modal method, the modified modal method, Nelson's method and Lee and Jung's method. A number of the aforementioned methods can be applied to the damped system; Pomazal and Snyder, O'Callaham and Aritabile have considered systems with damping and Lee, Kim and Jung extended Lee and Jung's method to damped systems recently.

This paper presents a very simple procedure for determining the sensitivities of the eigenpairs of damped vibratory system with distinct eigenvalues. The eigenpairs derivatives can be obtained by solving algebraic equation with a symmetric coefficient matrix whose order is $(n+1)\times(n+1)$, where n is the number of degree of freedom. The method is an improvement of recent work by I. W. Lee, D. O. Kim and G. H. Jung; the key idea is that the eigenvalue derivatives and the eigenvector derivatives are obtained at once via only one algebraic equation, instead of using two equations separately as like in Lee and Jung's method. Of course, the method preserves the advantages of Lee and Jung's method.

REFERENCES

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