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A family of Craig-Bampton methods considering residual mode compensation. (English)

Zbl 1433.74105
Appl. Math. Comput. 369, Article ID 124822, 15 p. (2020).

Summary: In this paper, we investigate the formulation of a family of Craig-Bampton (CB) methods considering residual modes by O'Callahan's approximation and adding generalized coordinate vectors containing unknown eigenvalues. In addition, we propose an nth-order higher-order CB+ (HCBn+) method for compensating the $(n+1)$th residual flexibility in the nth-order HCB (HCBn) method by O'Callahan's approach. Therefore, various CB methods with improved performance, such as the enhanced Craig-Bampton (ECB) method, which uses O'Callahan's approximation, and the higher-order Craig-Bampton (HCB) method, which adds generalized coordinate vectors, and HCB+ are employed for the comparison of performance with the aid of multiprecision computing. Through three benchmark examples, it is revealed that the HCB1+ method, a modified version of the first-order HCB method (HCB1) with the aid of O'Callahan's approximation proposed, shows better performance than HCB1 with the same number of retained modes. However, HCB2+ and HCB3+, modified versions of the second- and third-order HCB method, respectively, cannot be improved further. From the results, we concluded that this was due to the limitation of O'Callahan's approach, which many researchers have fundamentally questioned.

MSC:

74S05 Finite element methods applied to problems in solid mechanics
65M60 Finite element, Rayleigh-Ritz and Galerkin methods for initial value and initial-boundary value problems involving PDEs
65N30 Finite element, Rayleigh-Ritz and Galerkin methods for boundary value problems involving PDEs

Keywords:

Craig-Bampton; O'Callahan's approach; structural dynamics; residual mode compensation; enhanced Craig-Bampton; higher-order Craig-Bampton

Software:

ABAQUS; advanpix

Full Text: DOI

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