Precise integration dynamic analysis of equivalent spring particle elements in the continuum mechanics

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Abstract.

In this paper, the equivalent spring particle elements models of the two-dimensional and three-dimensional continuum are studied. The spring-particle coupling model of the continuous medium is obtained based on the displacement equivalent principle in static and dynamic analysis. The equivalent statically indeterminate trusses system is involved in general computational mechanics software, which will provide the same stiffness of the spring-particle coupling model. The proposed 2D&3D spring-particle coupling calculation model can be used in the dynamic characteristic analysis and the time-history analysis.

By using the equivalent spring particle element model as the basic analysis unit, the static analysis and dynamic analysis of the rectangular two-dimensional continuum and triangular prism three-dimension continuum are studied. The results show that the proposed novel computational method can provide high precise solution. Comparing with the commonly used finite element model in continuous medium, the computational efficiency of the equivalent spring particle element model is higher.

A novel precise integration method is introduced in the dynamic analysis of equivalent spring particle element model. Due to the advantage that it doesn't store the data of total stiffness matrix, the proposed novel precise integration method can improve the computational efficiency in a great degree. Especially, the proposed equivalent spring particle element model can give better convergence property in time-history analysis, comparing with the same-size finite element method.

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