عنوان مقاله:

Comparison of Two Computational Microstructure Models for Predicting Effective Transverse Elastic Properties of Unidirectional Fiber Reinforced Composites

محل انتشار:

ماهنامه بین المللی مهندسی, دوره 31, شماره 9 (سال: 1397)

تعداد صفحات اصل مقاله: 7

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خلاصه مقاله:

Characterization of properties of composites has attracted a great deal of attention towards exploring their applications in engineering. The purpose of this work is to study the difference of two computational microstructure models which are widely used for determining effective transverse elastic properties of unidirectional fiber reinforced composites. The first model based on the classic mechanics of materials permits free unloaded opposite boundaries in the unite cell, while the second one introduces straight-edge constraints in the unite cell to represent interactions of neighboring cells during deformation. The two approaches are firstly verified by the periodic circular hole problems. Then three microstructures are taken into consideration including the circular fibers, square fibers, and circular fiber clusters periodically embedded in the matrix and solved by finite element analysis. A comparison of the numerical results demonstrates that the two computational models with and without periodic conditions can give different predictions on the effective elastic properties of composite for both low and high fiber volume fractions, especially for the effective Poisson’s ratio of composite. Applying periodic straight-edge constraints after deformation can prevent any over-constrained conditions in the numerical model and give more stable results.

کلمات کلیدی:

Fiber, reinforced composite, effective transverse elastic properties, free boundary, straight, edge boundary, Finite Element