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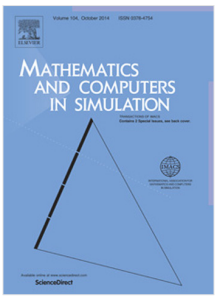

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A multiscale separated representation to compute the mechanical behavior of composites with periodic microstructure

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Abstract

The requirements for advanced numerical computations are very high when studying the multiscale behaviour of heterogeneous structures such as composites. For the description of local phenomena taking place on the microscopic scale, the computation must involve a fine discretization of the structure. This condition leads to problems with a high number of degrees of freedom that lead to prohibitive computational costs when using classical numerical methods such as the finite element method (FEM). To overcome these problems, this paper presents a new domain decomposition method based on the proper generalized decomposition (PGD) to predict the behaviour of periodic composite structures. Several numerical tests are presented. The PGD results are compared with those obtained using the classical finite element method. A very good agreement is observed.

Keywords: Model reduction, Multiscale simulations, Proper Generalized Decomposition, Composite structures

1. Introduction

One of the main challenges in mechanics and engineering is to account for physical phenomena that occur at different scales. A coupling between scales is often observed, generating a real need for multiscale models in many applications. In composite materials, for example, there are at least two or three characteristic scales: the fiber scale, the ply scale and the laminate scale. A major difficulty related to multiscale modeling is the need of multiscale solvers

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