6th European Conference on Computational Mechanics (ECCM 6)
7th European Conference on Computational Fluid Dynamics (ECFD 7)
11 15 June 2018, Glasgow, UK

INCLUSION OF HIGHER-ORDER TERMS IN FFT-BASED HOMOGENIZATION FOR PERIODIC MEDIA IN LINEAR ELASTICITY IN A MULTISCALE MODEL

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Key words: *Homogenization, FFT, Periodic Microstructures, Linear Elasticity, Multiscale Model*

In 1994, Moulinec and Suquet introduced a FFT-based numerical scheme to efficiently compute the solution of homogenization problems on periodic microstructures [1]. Several specialized variants and extensions were developed, one of them a generalization to higher-order problems, which allows the prescription of macroscopic derivatives of arbitrary order [2].

Let ϵ denote the mean-free microscopic strain, C a stiffness distribution, and let p and g be order-dependent polarization and body force terms. In this presentation, the algorithm by Moulinec and Suquet is shown in the context of quasi-static linear elasticity. It is then highlighted, how the generalized homogenization problem

$$\nabla \cdot \Big(C(x) : \epsilon(x) + p(x) \Big) + g(x) = 0$$

is derived using an asymptotic expansion ansatz [3]. The hierarchical structure and the dependencies of those problems among each other are pointed out. In the end, the effective properties of exemplary representative volume elements are computed and integrated in a FE-FFT multiscale simulation to test the influence of higher-order terms [4].

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