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

NUMERICAL HOMOGENIZATION AND MODEL ORDER REDUCTION FOR SOLVING LINEAR ELASTICITY PROBLEMS IN PERFORATED DOMAINS

A. Abdulle[1] and A. Di Blasio*

[1] ANMC-MATH, École Polytechnique Fédérale de Lausanne, assyr.abdulle@epfl.ch
* ANMC-MATH, École Polytechnique Fédérale de Lausanne, andrea.diblasio@epfl.ch

Keywords: *Numerical homogenization, reduced basis method, computational mechanics*

Many applications in engineering are concerned with partial differential equations defined in multiscale perforated domains, characterized by a microscopic geometry. We can mention problems in heat conduction, geoscience or medical imaging. In [1] we present a method for solving problems in elasticity with perforated domains. Using standard finite element methods (FEMs) to solve an elastic problem in a perforated domain D^ε, where ε the typical length of the hole is small, can become prohibitive in terms of computational cost, due to the required mesh resolution of the micro geometry. In this talk we discuss an alternative method obtained by combining numerical homogenization and reduced basis techniques to obtain the effective displacement and stress at a cost that scales with the macroscopic mesh. We present a rigorous formulation of our method, and show convergence results for both periodic and random perforated domains. Numerical examples illustrate the performance and versatility of the proposed method.

REFERENCES

[1] A. Abdulle and A. Di Blasio, Reduced basis finite element heterogeneous multiscale method for homogenization problems in elasticity with perforated domains. *Preprint*, 2018.