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Analysis of a coupling method for the practical computation of homogenized coefficients

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In this talk, we formalize the approach originally introduced in [Cottereau, R. (2013). Numerical strategy for unbiased homogenization of random materials. International journal for numerical methods in engineering, 95(1), 71-90]. The approach aims at evaluating the effective (a.k.a. homogenized) coefficient of a medium with some fine-scale structure. It combines, using the Arlequin coupling method, the original fine-scale description of the medium with an effective description and optimizes upon the coefficient of the effective medium to best fit the response of a purely homogeneous medium.

We prove that the approach is mathematically well-posed and that it provides, under suitable assumptions, the actual value of the homogenized coefficient of the original medium in the limit of asymptotically infinitely fine structures. We also present a number of algorithmic improvements of the approach along with representative numerical experiments on several test cases that are provided in [Gorynina, O., Le Bris, C., & Legoll, F. (2020). Some remarks on a coupling method for the practical computation of homogenized coefficients. arXiv preprint arXiv:2005.09760]. This work is partially supported by EOARD under Grant FA9550-17-1-0294.

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