Multilevel Quadrature for Elliptic Problems on Random Domains by the Coupling of FEM and BEM

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Elliptic boundary value problems which are posed on a random domain can be mapped to a fixed, nominal domain. The randomness is thus transferred to the diffusion matrix and the loading. This domain mapping method is quite efficient for theory and practice, since only a single domain discretisation is needed. Nonetheless, it is not useful for applying multilevel accelerated methods to efficiently deal with the random parameter. This issues from the fact that the domain discretisation needs to be fine enough in order to avoid indefinite diffusion matrices. To overcome this obstruction, we couple the finite element method with the boundary element method. We verify the required regularity of the solution with respect to the random perturbation field for the use of multilevel methods, derive the coupling formulation, and show by numerical results that the approach is feasible.

References:

[1] H. Harbrecht and M. Schmidlin, *Multilevel quadrature for elliptic problems on random domains by the coupling of FEM and BEM*. ArXiv e-prints arXiv:1802.05966, 2018.

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