

”Homogenization of elasticity equations without scale separation”

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Abstract: In this joint work with H. Owhadi, we investigate the homogenization of divergence form elliptic (scalar and vectorial) equations with arbitrary bounded coefficients (in particular, in situations where assumptions of scale separation and/or ergodicity are not satisfied). We prove the existence of an h -basis that is superior to standard piecewise polynomial bases with the same number of degrees of freedom. We also obtain an explicit error constant for h -basis approximations, which is independent of the contrast of the material and geometry of its microstructure. We also discuss minimization of the number of ”cell” (precomputed) problems for homogenization with arbitrary bounded coefficients and show that this issue is related to a new class of analytical inequalities (work in progress). Finally, we will discuss potential applications of this work ranging from brain damage and virtual liver surgery to reservoir modeling and upscaling of atomistic models.