

Radial basis function partition of unity methods for PDEs

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With a radial basis function (RBF) partition of unity method (PUM), we aim to leverage the spectral convergence properties and meshfree nature of global RBF approximations, while significantly reducing the computational cost. In RBF-PUM, local RBF approximations are combined using partition of unity weight functions to form the global approximation. When RBF-PUM is used for interpolation the local subproblems can be solved independently. If the target is instead to solve a PDE, the subproblems are coupled. Two different approaches to solving the PDE and coupling the subproblems will be discussed; a collocation approach and a least squares approach. A theoretical analysis of the convergence properties provides qualitative insights into the trade-offs offered by different formulations. We then use numerical experiments to investigate these quantitatively. Already the collocation RBF-PUM has shown competitive results compared with other numerical methods. The least squares RBF-PUM is however even more efficient than the collocation RBF-PUM. Both RBF-PUM methods are promising methods for PDEs. Current research topics include iterative solvers and adaptive approximations.