Analysis of the parallel Schwarz method for growing chains of fixed-sized subdomains

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Abstract:
A new class of Schwarz methods was recently presented in the literature for the solution of solvation models, where the electrostatic energy contribution to the solvation energy can be computed by solving a system of elliptic partial differential equations [1,2]. Numerical simulations have shown an unusual convergence behaviour of Schwarz methods for the solution of this problem, where each atom corresponds to a subdomain: the convergence of the Schwarz methods is independent of the number of atoms [1], even though there is no coarse grid correction. Despite the successful implementation of Schwarz methods for this solvation model, a rigorous analysis for this unusual convergence behaviour is required, since no theoretical results are given in the corresponding literature. In this talk, we analyze the behavior of the Schwarz method for the solution of a chain of atoms and show that its convergence does not depend on the number of atoms (subdomains). We use two different techniques to prove this result. The first technique is based on a Fourier expansion of the error and the analysis of transfer matrices constructed for an approximate model. The second one consists in an application of the maximum-principle and allows us to analyze very general geometries.


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