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An additive Schwarz preconditioner for the weakly over-penalized symmetric interior penalty method

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We introduce and study numerically an additive Schwarz preconditioner for the weakly over-penalized symmetric interior penalty method. The WOPSIP method has many desirable properties for parallel computing. These include small communication requirements at subdomain boundaries, the ease with which meshes can be adaptively refined, and intrinsic parallelism in the resulting matrix systems if the unknowns are ordered properly. The additive Schwarz preconditioner is also well-suited for parallel computing, and we show that the combination shows great promise as a parallel algorithm. We prove optimal estimates for the condition number of the preconditioned system under appropriate conditions, and show numerically that the method scales well on parallel machines and is effective for solving elliptic problems.