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Sobolev preconditioning for the Poisson-Boltzmann equation. (English) Zbl 0960.82035

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Summary: This paper presents an overview of least-squares steepest descent using Sobolev gradients for several prototype differential equations. In the linear case, the method is viewed as a very effective preconditioning strategy for the basic iterative method which arises from steepest descent, in particular, it acts to smooth the Euclidean gradient. Results are given for the one-dimensional Poisson-Boltzmann equation from semiconductor device modeling.

MSC:

82D37 Statistical mechanical studies of semiconductors
65M60 Finite element, Rayleigh-Ritz and Galerkin methods for initial value and initial-boundary value problems involving PDEs
65F35 Numerical computation of matrix norms, conditioning, scaling

Keywords:

least-squares steepest descent; Sobolev gradients; Poisson-Boltzmann equation; semiconductor device modeling

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