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**Two-stage fictitious components method for solving the Dirichlet boundary value problem.**  
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**Summary:** The Dirichlet boundary value problem is considered for an elliptic equation with piecewise-smooth coefficients in two- and three-dimensional domains with complex internal and external curvilinear boundaries. To approximate the boundary value problem, the standard finite element method is used on rectangular meshes locally adapted to the boundaries. Systems of mesh equations arising are solved by a two-stage iterative method. This method involves the use of spectrally equivalent operators with constant coefficients as an outer iterative procedure and of the nonsymmetric version of the fictitious components method as an inner iterative procedure. The paper contains convergence rate estimates for the method discussed, proposes algorithms of its realization as a computational process in a subspace, gives estimates for the arithmetic and communication complexity of the algorithms suggested. The paper ends with the results of a numerical experiment to solve a specific three-dimensional problem of electrostatics.

**MSC:**

- [65N30](#) Finite element, Rayleigh-Ritz and Galerkin methods for boundary value problems involving PDEs Cited in **9** Documents
- [65F10](#) Iterative numerical methods for linear systems
- [65Y20](#) Complexity and performance of numerical algorithms
- [35J25](#) Boundary value problems for second-order elliptic equations

**Keywords:**

[Dirichlet boundary value problem](#); [finite element method](#); [iterative method](#); [fictitious components method](#); [convergence](#); [algorithms](#); [complexity](#); [numerical experiment](#); [electrostatics](#); [elliptic equation](#)