Solving the nonlinear Poisson-type problems with F-Trefftz hybrid finite element model

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ABSTRACT

A hybrid finite element model based on F-Trefftz kernels or the fundamental solution is formulated for the solution of the nonlinear Dirichlet problems associated with two-dimensional nonlinear Poisson-type equations including nonlinear Poisson-Boltzmann equation and diffusion-reaction equation. The nonlinear right-hand forcing term in the nonlinear Poisson-type equation is frozen by introducing the imaginary terms at each Picard iteration step, and then the induced Poisson problem is solved by the present hybrid finite element model involving element boundary integrals only, coupling with the particular solution method with radial basis function interpolation. The numerical accuracy of the present method is investigated by numerical experiments in complex domain with various nonlinear forcing functions, and at the same time, both the iteration residual and the inter-iteration difference are monitored for convergence demonstration.

KEY WORDS*:* Nonlinear Poisson-type equation; hybrid finite element method; fundamental solution; radial basis function