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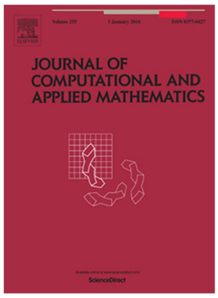

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Numerical Approximation of Equations Involving Minimal/Maximal Operators by Successive Solution of Obstacle Problems[*][†]

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Abstract

Let $\Omega \subset \mathbb{R}^2$ be a polygonal domain, and let L_i, $i = 1, 2$, be two elliptic operators of the form

$$L_i u(x) := -\operatorname{div}(A_i\,(x)\,\nabla u(x)) + c_i\,(x)\,u(x) - f_i\,(x)\,.$$

Motivated by the results in [2], we propose a numerical iterative method to compute the numerical approximation to the solution of the minimal problem

$$\begin{cases} \min\{L_1 u, L_2 u\} = 0 & \text{in } \Omega, \\ u = 0 & \text{on } \partial\Omega. \end{cases}$$

The convergence of the method is proved, and numerical examples illustrating our results are included.

1 Introduction

Let $\Omega \subset \mathbb{R}^2$ be a polygon with largest interior angle less than or equal to $\pi/2$, and let L_i, $i = 1, 2$, be two elliptic operators of the form

$$L_i u(x) := -\operatorname{div}(A_i\,(x)\,\nabla u(x)) + c_i\,(x)\,u(x) - f_i\,(x)\,,$$

where $A_i := [a_{jk}]_{2\times 2}$ with $a_{jk} \in C^1(\overline{\Omega})$, $0 \le c_i \in L^\infty(\Omega)$ and $f_i \in L^p\,(\Omega)$ for some $p > 2$. Assume also that the operators are uniformly elliptic, that is, there exist $\Lambda, \lambda > 0$ such that $\Lambda\,|\xi|^2 \ge \langle A_i\,(x)\,\xi, \xi\rangle \ge \lambda\,|\xi|^2$ for all $\xi \in \mathbb{R}^2$.

Although for simplicity we confine our analysis to two-dimensional polygons, one should be able to obtain similar results for $C^{1,1}$ domains Ω in $\mathbb{R}^3$, approximating Ω with a sequence of polyhedrons Ω_h, proceeding as in [9].

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