ICM 1998, Berlin, Aug. 18–27

Abstracts of Short Communications and Posters

Section:

12. Probability and Statistics

1991 MS Classification: 35, 60
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Singularly perturbed Dirichlet problems in randomly perforated domains

We study the problem $-\varepsilon\Delta u^\varepsilon + u^\varepsilon = f$ in a domain Ω_ε in $\mathbf{R}^N$, which is obtained by perforating randomly from a bounded domain Ω approximately $m\varepsilon^{-q}$ holes whose size is of order ε^p $(N = 3)$ and $\exp(-a\varepsilon^{-p})$ $(N = 2)$, according to a positive probability density function $V(x) \in C^1(\bar{\Omega})$. The $L^2(\Omega)$ limit of u^ε in probability in the space of holes' configurations when $\varepsilon \to 0$, which depends on p and q and an order of convergence are presented. Results of Le Gall on fluctuation of the Wiener sausage and Sznitman's long time asymptotics of the shrinking Wiener sausage together with the Feynman-Kac formula are employed.