Asymptotics of solutions to nonstationary Maxwell system in domain with small holes

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Let $\Omega(\varepsilon)$ be a bounded domain in $\mathbb{R}^3$ with finite number of small holes with diameters proportional to the small parameter ε. In $\Omega(\varepsilon)$ we consider a non-stationary Maxwell system with perfect conductivity or impedance boundary conditions on $\partial\Omega(\varepsilon)$ with time t runs $-\infty$ to ∞. We derive complete asymptotic expansions of solutions as $\varepsilon \to 0$. This mathematical model describes behavior of the electromagnetic field inside the cavity resonator filled with plasma contaminated with small metal particles.

To this end, we use the method of compound asymptotic expansions (for elliptic problems in singularly perturbed domains, the method of compound expansions was presented in [1]). In this method, the asymptotics of solutions is constructed from solutions of "limit problems" not depending on ε. The specific character of the situation considered in present work is that one of limit problems is dynamic. Therefore, when describing the asymptotics of a solution to this problem, we used methods and results from the theory of nonstationary (hyperbolic) boundary value problems in domains with piecewise smooth boundary, presented in [2],[3].

References

[1] V.G. Maz'ya, S.A. Nazarov, B.A. Plamenevskii, *Asymptotic theory of elliptic boundary value problems in singularly perturbed domains*, v. 1, Birkhäuser, Basel–Boston–Berlin (2000).

[2] B.A. Plamenevskii, *On the Dirichlet problem for the wave equation in a cylinder with edges*, Algebra i Analiz **10** (1998), no. 2, 197–228; English transl. in St. Petersburg Math. J. **10** (1999), no. 2, 373–397.

[3] S.I. Matyukevich, *On the nonstationary Maxwell system in domains with edges*, Algebra i Analiz **15** (2003), no. 6, 86–140; English transl. in St. Petersburg Math. J.**15**:6 (2004), 875–913.