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ASYMPTOTIC EXPANSION FOR THE DENSITY OF THE DOUBLE LAYER POTENTIAL OF A THIN ELLIPSE

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The paper is devoted to the construction of a formal asymptotic expansion for the density of the double layer potential of a thin ellipse whose width is characterized by a small parameter. The potential is a solution to the Dirichlet problem for the Laplace equation in the exterior of the ellipse. The physical interpretation can be the function of a laminar flow of an ideal fluid around a thin body. We should note that the solution of this boundary value problem was not the aim of the paper, since it can be easily found by a conformal mapping of the exterior of a disk to the exterior of the ellipse. However, this problem can be viewed as a model example for the method of finding asymptotic expansions for solutions of boundary value problems for the Laplace equation in the exterior of thin domains that we consider in this paper. The analysis can be easily transferred to three-dimensional space, where the techniques of conformal mappings do not work. The method is based on expanding both sides of the equation for the double layer potential in the small parameter and then equating the coefficients at the same powers of the parameter. We consider the difficulties of constructing the asymptotic expansion by this method and formulate a number of unsolved problems.

Keywords: multidimensional integral, small parameter, asymptotic expansion, singularity subtraction method, double layer potential, Laplace equation.

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