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ON THE COMBINATION OF ROTHE'S METHOD AND BOUNDARY INTEGRAL EQUATIONS FOR THE NONSTATIONARY STOKES EQUATION

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ABSTRACT. We consider the exterior initial boundary value problem for the Stokes equation with Dirichlet boundary condition in $\mathbf{R}^2$. Using Rothe's method, the nonstationary problem is reduced to a system of boundary value problems for the Stokes resolvent equations. By a special approach we obtain a system of boundary integral equations and use a trigonometric quadrature method for the numerical solution. Numerical examples are presented.

1. Introduction and Rothe's method. The boundary integral equation method for the solution of boundary value problems in various applied sciences has been successfully applied for a long time. In the case of nonstationary problems, the use of this method is possible in different variants [**2**]. In one approach the initial boundary value problem can be directly reduced to time-dependent boundary integral equations by potential theory or by Green's formula [**8**], [**9**], [**13**]. Another method consists of having a preliminary semi-discretization of the time-dependent problem and reducing it to boundary value problems for elliptic equations, for example by an integral transformation. Then the integral equation method can be used for the time-independent problems [**2**], [**3**], [**7**]. Sometimes the combination of Laplace transform and boundary integral equations is used. But in this case some essential difficulties arise during numerical calculation of the inverse Laplace transformation (see [**2**]).

One of the possibilities for the semi-discretization consists of using Rothe's method with respect to the time variable. This method is also known as backwards Euler procedure or horizontal line method and is applied both to parabolic and hyperbolic problems. As a result one obtains boundary value problems for the elliptic equation with a recursive righthand side which contains solutions on previous

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