Axisymmetric collocation boundary-element-method on polygonal boundary

O. A. Lavrova, V. K. Polevikov (Minsk, Belarus)

We consider an exterior transmission problem in terms of the potential

$$\nabla \cdot (\nabla u_1) = 0 \quad \text{in } \Omega, \qquad \nabla \cdot (\nabla u_2) = 0 \quad \text{in } R^3 \setminus \Omega \tag{1}$$

with transmission conditions on the interface $S := \partial\Omega$

$$u_1 = u_2, \quad \mu \frac{\partial u_1}{\partial n} = \frac{\partial u_2}{\partial n} \quad \text{on } S, \tag{2}$$

and a radiation condition

$$\lim_{|\xi| \to \infty} u_2 = H_0 z. \tag{3}$$

Here Ω is a bounded domain, $\mu = \mu_1/\mu_2$ the constant relative permeability and $\xi = (x, y, z)$. This model describes the linearly-magnetizable (polarizable) nonconducting media in a uniform applied magnetic (electric) field $\mathbf{H}_0 = (0, 0, H_0)$.

The problem (1)–(3) allows the reformulation as two integral equations in the meridian plane for the boundary potential and the boundary flux, which can be solved successively. The second kind integral equation is formulated only for the potential. The first kind integral equation for the flux contains the potential only at the right-hand side [1].

The numerical method is an axisymmetric collocation with equal order approximations of the boundary unknowns on a polygonal boundary. The complete elliptic integrals of the kernels are approximated by polynomials. An asymptotic kernels behavior is analyzed for accurate numerical evaluation of integrals.

A piecewise-constant midpoint collocation and a piecewise-linear nodal collocation on a circular arc and on its polygonal interpolation are used for test computations on uniform meshes. We analyze empirically the influence of the polygonal boundary interpolation to the accuracy and the convergence of the presented method.

Acknowledgement. The authors want to thank the Belarusian Republican Foundation for Fundamental Research for financial support of the project 1.5.03.2 within the State Research Program "Convergence".

References

1. *Lavrova O. A., Polevikov V. K.* Application of collocation BEM for axisymmetric transmission problems in electro- and magnetostatics. *Math. Model. Analysis*, submitted for publication.