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NON-LOCAL BOUNDARY CONDITION IN A COMPUTATIONAL DOMAIN OF EXTERIOR PROBLEMS

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Physical problems of interest are often defined in unbounded domains, for example, so are the electromagnetic problems and flow problems in infinite domains. The point here is how to calculate the numerical solution more accurately using the non-local boundary condition proposed by Jo, et al.[1] The key idea comes from the Axial Green function Methods which starts in 2008 by the paper [5]. The Axial Green function Methods enable us to calculate the electromagnetic field[2] and the Stokes flow[4] in arbitrary domains, including the convection-dominated problem[3] in complicated domains. While these previous works are conducted in bounded domains, the problems in unbounded domain is in fact most interesting. They have asymptotic behaviors at far boundaries, for instance, $u(\mathbf{x}) \sim u_0(\mathbf{x}) + C\, u_1(\mathbf{x})$ as $\mathbf{x}$ goes to infinity. As usual, the leading behavior u_0 and the next one u_1 are prescribed but the constant C is not determined a priori. Using the non-local boundary condition, we finally compute the unknown constant C as well as the numerical solution $u^h(\mathbf{x})$ in a smaller computational region compared to the larger truncated computational region on which artificial Dirichlet or Neumann boundary condition is given.

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