Dipole Simulation Method and Its Application to Numerical Conformal Mappings

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In this study, we propose a dipole simulation method for two-dimensional potential problems (Dirichlet problems of the Laplace equation). This method is an extension of the charge simulation method (the method of fundamental solutions) and approximates the solution by a linear combination of the potentials due to electric dipoles positioned in the exterior of the problem region instead of point charges. The approximate potential satisfies the property that it is bounded at infinity, which is often assumed in many potential problems. We also apply the proposed method to the numerical conformal mapping of an exterior simply-connected region onto the exterior of the unit disk. The approximate mapping function by the dipole simulation method is expressed by using a complex rational function and it is free of the discontinuities due to the principal values of the complex logarithmic functions used in numerical conformal mappings by the charge simulation method.

Keywords: dipole simulation method, charge simulation method, method of fundamental solutions, potential problem, Laplace equation, conformal mapping