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Electric Potential Surrounding Two Conducting Spheres: An Exercise for Advancing Student Understanding of the Method of Relaxation
HUGH GALLAGHER, BRIDGET CHARTRAND, JOHN BEACH, SUNY College at Oneonta — In undergraduate computational physics courses, the method of relaxation provides a well-established technique for obtaining solutions to Laplace's Equation. The technique's value stems from its accessibility and clear dependence on the properties of solutions to Laplace's Equation. We have created an exercise that allows students to develop an experiential understanding of the method of images and its connection to the properties of solutions to Laplace's Equation. The problem of two conducting spheres separated by a relatively small distance and maintained at fixed but distinct electric potentials is considered. Using the method of relaxation, students solve the problem in two-dimensions, three-dimensions with a Dirichlet condition on the outer boundary and three-dimensions using a Neumann condition on the outer boundary. At each step, the results are compared to a solution obtained using the method of images for a spherical conductor in an iterative fashion. Through this comparison, students gain insight into the significance of their choices for the solving the problem using the method of relaxation. We will discuss application of the relaxation method to this problem, validation by the method of images, and potential use in an undergraduate computational physics course.

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