

# Use of Maple in Determining Radial Eigenfunctions for the Bound-State Aharonov-Bohm Effect

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## Abstract

Numerical and graphical representations of radial eigenfunctions for a charged particle contained in a cylindrical shell are obtained by using Maple. The general solution of the radial Schrödinger equation can be expressed analytically in terms of Bessel functions and confluent hypergeometric functions when there is no magnetic-induction field and a constant longitudinal magnetic-induction field, respectively, in the shell. In both cases, the transcendental equation arising from imposition of the boundary conditions is solved numerically to obtain approximations to the eigenvalues. The bound-state Aharonov-Bohm effect is exhibited through the change in the eigenfunctions due to a longitudinal magnetic-induction field confined within the inner cylinder, which the charged particle cannot penetrate. This paper is partly based on a fourth-year (Honours) student project and illustrates some of the numerical and graphical capabilities that modern computer algebra systems such as Maple make available to students.