A symbolic-numerical algorithm for evaluating matrix elements between the oblate angular spheroidal functions and their derivatives by a parameter.

O. Chuluunbaatar, V.P. Gerdt, A.A. Gusev, M.S. Kaschiev*,
V.A. Rostovtsev, V.N. Samoylov, T.V. Tupikova, S.I. Vinitsky
Joint Institute for Nuclear Research
Dubna, Moscow Region
* Institute of Mathematics and Informatics
Bulgarian Academy of Science
Sofia, Bulgaria

Abstract

A symbolic-numerical algorithm for evaluating with the given accuracy the oblate angular spheroidal functions and corresponding eigenvalues which depend on the parameter, their derivatives with respect to the parameter and matrix elements is presented. These matrix elements are given by integrals over the angular variable between the oblate angular spheroidal functions depending on the radial variable as a parameter and their derivatives with respect to the parameter. Asymptotic solutions in spherical and cylindrical coordinate systems are presented. It provides an appropriate approximation by a finite number of the radial equations that corresponds to approximate separation of variables. The efficiency and accuracy of the algorithm and of the numerical scheme derived are confirmed by computations of eigenenergies and eigenfunctions for the low-exited states of a hydrogen atom in the uniform magnetic field and comparison with known data.