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Neumann's function and its derivatives constructed for the exterior of an ellipsoid and adapted to an iteration solution of the linear gravimetric boundary value problem

Petr Holota (1) and Otakar Nesvadba (2)

(1) Research Institute of Geodesy, Topography and Cartography, 250 66 Zdiby 98, Prague-East, Czech Republic (e-mail: petr.holota@pecny.cz), (2) Land Survey Office, Pod Sídlištěm 9, 182 11 Prague 8, Czech Republic (e-mail: nesvadba@sky.cz)

For geodesy and for gravity field studies in particular the theory of boundary-value problems is of great importance. In this paper the exterior Neumann problem and its close relation to the solution of the linear gravimetric boundary value problem are discussed. For the solution domain given by the exterior of an ellipsoid of revolution the attention is paid to Green's function representation of the solution and to the construction of Green's function of the second kind, i.e. Neumann's function, including the construction of its derivatives. The mutual relation between Green's function of the first kind, Neumann's function and the reproducing kernel of the respective Hilbert space is shown and used for this purpose. Ellipsoidal harmonics represent an efficient tool in constructing these integral kernels. Within the approach applied they are expressed by infinite hypergeometric series. The series then appear also in Neumann's function. The summation problems are solved in two independent ways, by a direct numerical approach and by means of analytical steps leading to closed formulas based on elliptic integrals. The results are confronted, subjected to numerical tests and discussed.