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A new method for solving fixed geodetic boundary-value problem based on harmonic splines

Abdolreza Safari and Mohammad Ali Sharifi

Department of Surveying and Geomatics Engineering, College of engineering, University of Tehran, Tehran, Islamic Republic Of Iran (asafari@ut.ac.ir)

Nowadays, the determination of the earth gravity field has various applications in geodesy and geophysics. The gravity field of the earth is determined via solution of a boundary value problem. Gravimetric data with high quality at the earth surface for Earth's gravity field determination are available. These data provide the necessary boundary data to solve our BVP. Because of precise GNSS-based positioning in gravimetric stations, boundary is assumed as a fixed surface. In this paper, a new method to solve fixed BVP based on harmonic splines is discussed. Algorithmic steps to solve fixed boundary value problem for the Earth surface computation can be described as follows: (i) Remove the effect of a high degree/order ellipsoidal harmonic expansion and centrifugal field at the observation point at the Earth surface (ii) Remove the effect of residual terrain at the observation point (iii) Find an approximation to gravity disturbances at the Earth surfaces by using harmonic spline (iv) Restore the effect of reference field and residual terrain at the surface of the Earth. this new methodology is successfully tested by computation of the surface potential at the west area of Iran.