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On the application of the infinite element method to geodetic boundary value problem

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Our aim is to introduce the infinite element method for solving the geodetic boundary value problems. The main idea is to create the 3D computational domain bounded by a chosen part of the Earth's surface Γ_1, four side boundaries $\Gamma_2, \ldots, \Gamma_5$ and one upper spherical boundary Γ_6 away from the Earth surface. Afterwards, such domain is divided in radial direction into two subdomains. The lower subdomain is meshed by finite elements whereas the upper one is meshed by infinite elements used to represent an exterior subdomain of semi-infinite extent. Then our geodetic problem consists of the Laplace equation accompanied by (i) Neumann boundary conditions (BCs) in the form of gravity disturbances (ii) Newton BCs in the form of gravity anomalies that are prescribed on Γ_1 and Dirichlet BCs in the form of disturbing potential on $\Gamma_2, \ldots, \Gamma_5$. Finally, our approach using the synthetic BCs computed from a Synthetic Earth Gravity Model (SEGM) as an input data is compared and tested by data generated directly from SEGM and the solution by the finite element method. The results show good qualitative correspondence with synthetically generated quantities in all tests.