EGU21-2614
https://doi.org/10.5194/egusphere-egu21-2614
EGU General Assembly 2021

Stable finite element method for solving the oblique derivative boundary value problems in geodesy

Marek Macák, Zuzana Minarechová, Róbert Čunderlík, and Karol Mikula
Slovak University of Technology, Faculty of Civil Engineering, Department of Mathematics and Descriptive Geometry, Bratislava, Slovakia (m.macak@gmail.com)

We presents local gravity field modelling in a spatial domain using the finite element method (FEM). FEM as a numerical method is applied for solving the geodetic boundary value problem with oblique derivative boundary conditions (BC). We derive a novel FEM numerical scheme which is the second order accurate and more stable than the previous one published in [1]. A main difference is in applying the oblique derivative BC. While in the previous FEM approach it is considered as an average value on the bottom side of finite elements, the novel FEM approach is based on the oblique derivative BC considered in relevant computational nodes. Such an approach should reduce a loss of accuracy due to averaging. Numerical experiments present (i) a reconstruction of EGM2008 as a harmonic function over the extremely complicated Earth's topography in the Himalayas and Tibetan Plateau, and (ii) local gravity field modelling in Slovakia with the high-resolution 100 x 100 m while using terrestrial gravimetric data.

[1] Macák, Z. Minarechová, R. Čunderlík, K. Mikula, The finite element method as a tool to solve the oblique derivative boundary value problem in geodesy. Tatra Mountains Mathematical Publications. Vol. 75, no. 1, 63-80, (2020)