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Gravimetric Quasigeoid in Slovakia by the Finite Element Method

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Abstract: The paper presents the solution to the geodetic boundary value problem by the finite element method in area of Slovak Republic. Generally, we have made two numerical experiments. In the first one, Neumann BC in the form of gravity disturbances generated from EGM-96 is used and the solution is verified by the quasigeoidal heights generated directly from EGM-96. In the second one, Neumann BC is computed from gravity measurements and the solution is compared to the quasigeoidal heights obtained by GPS/leveling method.

Keywords: finite element method; geodetic boundary value problem; ANSYS;

AMS Subject Classification: 35Q80; 65N30; 86A30;

References

[1] ANSYS, online tutorial: `www.ansys.stuba.sk`.

[2] S. C. Brenner and L. R. Scott: The Mathematical Theory of Finite Element Methods. Second edition. Springer–Verlag, New York 2002.

[3] R. Čunderlík, K. Mikula, and M. Mojzeš: The boundary element method applied to the determination of the global quasigeoid. In: Proc. ALGORITMY 2000, pp. 301–308.

[4] R. Čunderlík, K. Mikula, and M. Mojzeš: A comparison of the variational solution to the Neumann geodetic boundary value problem with the geopotential model EGM-96. Contributions to Geophysics and Geodesy 34 (2004), 3, 209–225.

[5] R. Čunderlík: The Boundary Element Method Applied to the Neumann Geodetic Boundary Value Problem. Ph.. Thesis. SvF STU, Bratislava 2004.

[6] R. Čunderlík and K. Mikula: Boundary Element Method for the gravity field modeling in the Himalayas. Slovak Journal of Civil Engineering 13 (2005), 4, 13–18.

[7] M. Klobušiak and J. Pecár: Model and algorithm of effective processing of gravity measurements performed with a group of absolute and relative gravimeters. GaKO 50/92, No. 4–5 (2004), 99–110.

[8] F. G. Lemione, S. C. Kenyon, J. K. Factor, R. G. Trimmer, N. K. Pavlis, D. S. Chinn, C. M. Cox, S. M. Klosko, S. B. Luthcke, M. H. Torrence, Y. M. Wang, R. G. Williamson, E. C. Pavlis, R. H. Rapp, and T. R. Olson: EGM-96 – The Development of the NASA GSFC and NIMA Joint Geopotential Model. `http://cddis.gsfc.nasa.gov/926/egm96/egm96.html`

[9] M. Mojzeš, J. Janák, and J. Papčo: Improvement of the gravimetric model of quasigeoid in Slovakia. Newton's Bulletin 3 (2006), `http://bgi.cnes.fr:8110/Mojzes.pdf`

[10] M. Mojzeš and J. Janák: New gravimetric quasigeoid of Slovakia. Bollettino Di Geofisica Teorica Ed Applicata 40 (1999), 3–4, 211–217.

[11] M. Mojzeš and J. Janák: Gravimetric model of Slovak quasigeoid. In: Second Continental Workshop on the Geoid in Europe, Budapest 1998.

[12] H. Moritz: Advanced Physical Geodesy. Helbert Wichmann Verlag, Karlsruhe 1980.

[13] M. Šprlák and J. Janák: Gravity field modeling. New program for gravity field modeling by spherical harmonic functions. GaKO 1 (2006), 1–8.

[14] J. N. Reddy: An Introduction to The Finite Element Method. Second edition. Mc Graw-Hill, Singapore 1993.

[15] K. Rektorys: Variational Methods in Engineering and in Mathematical Physics (in Czech). SNTL, Prague 1974.

[16] C. C. Tscherning, P. Knudsen, and R. Forsberg: Description of the GRAVSOFT Package. Geophysical Institute, University of Copenhagen, Technical Report, 1991.

[17] P. Vaníček and E. Krakiwsky: Geodesy – The Concepts. North–Holland, Amsterdam – New York – Oxford 1982.