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A new formula of the Gravitational Curvature for the prism

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Gravitational Curvatures (GC) are the components of the third-order gravitational tensor and physically represent the rate of change of the gravity gradient.
While scalar, vector and second-order tensor quantities of the Earth's gravitational field have extensively been studied and their properties have been well understood [1], the first successful terrestrial measurements of the third-order vertical gravitational gradients have been recently performed in [2] by atom interferometry sensors in laboratory environment.
Possible benefits of the airborne third-order gravitational gradients for exploration geophysics are discussed in [3] while Brieden et al. (2010) [4] have proposed a new satellite mission called OPTical Interferometry for global Mass change detection from space (OPTIMA) sensing the third-order gravitational gradients in space.
Moreover, exploitation of GC for modelling the Earth's gravitational field has been object of recent studies [5-7].
We extend the approach presented by the author in previous papers [8-10] by evaluating the algebraic expression of the third-order gravitational tensor for a prism. Comparisons with previous results [11-12] are also included.

[1] Freeden W, Schreiner M (2009) Spherical functions of mathematical geosciences. A scalar, vectorial, and tensorial setup. In: Advances in geophysical and environmental mechanics and mathematics. Springer, Berlin

[2] Rosi G, Cacciapuoti L, Sorrentino F, Menchetti M, Prevedelli M, Tino GM (2015) Measurements of the gravity-field curvature by atom interferometry. Phys Rev Lett 114:013001

[3] Di Francesco D, Meyer T, Christensen A, FitzGerald D (2009) Gravity gradiometry - today and tomorrow. In: 11th SAGA Biennial technical meeting and exhibition, 13–18 September 2009, Switzerland, pp 80–83

[4] Brieden P, Müller J, Flury J, Heinzel G (2010) The mission OPTIMA - novelties and benefit. In: Geotechnologien science report No. 17, Potsdam, pp 134–139

[5] Šprlák M, Novák P (2015) Integral formulas for computing a third-order gravitational tensor from volumetric mass density, disturbing gravitational potential, gravity anomaly and gravity disturbance. J Geod 89:141–157

[6] Šprlák M, Novák P (2016) Spherical gravitational curvature boundary-value problem. J Geod 90:727–739

[7] Hamáčková E, Šprlák M , Pitoňák M, Novák P (2016) Non-singular expressions for the spherical harmonic synthesis of gravitational curvatures in a local north-oriented reference frame. Comp & Geosc 88: 152–162

[8] D'Urso MG (2012) New expressions of the gravitational potential and its derivates for the prism. In Hotine-Marussi International Symposium on Mathematical Geodesy, 7rd. Sneeuw N, Novak P, Crespi M, Sansò F. Springer-Verlag, Berlin Heidelberg pp. 251-256

[9] D'Urso MG (2013) On the evaluation of the gravity effects of polyhedral bodies and a consistent treatment of related singularities. J Geod 87:239-252
[10] D'Urso MG (2014)Analytical computation of gravity effects for polyhedral bodies. J Geod 88:13-29
[11] Nagy D, Papp G, Benedek J (2000) The gravitational potential and its derivatives for the prism. J Geod 74:552–560
[12] Holstein H, Fitzgerald DJ, H. Stefanov H (2013) Gravimagnetic similarity for homogeneous rectangular prisms. 75th EAGE Conference & Exhibition, London