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Gravitoscopy of Earth's mass density distribution based on higher-order gradients of the gravitational potential

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Gravity data have been used to study the Earth's inner structure in terms of mass density distribution. According to Newton's law of gravitation the gravitational potential of any mass object in space can numerically be evaluated by integrating its mass density distribution function scaled by the universal gravitational constant and inverse Euclidean distance. In this contribution we present volume integrals of the Newtonian type for first-, second- and third-order gradients of the gravitational potential defined in a local Cartesian system. Spatio-spectral properties of their respective integral kernels represented by both analytical formulas and infinite series of Legendre functions are studied and their sensitivity with respect to particular mass density distributions are tested. The apparatus can be used for reduction and/or interpretation of observed gradient data.