R22a New approach to compute gravitational field of general object accurately

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We reviewed a recent progress in the computation of the gravitational field of a general object (Fukushima 2016a ,b, c, d; 2017a, b; 2018a, b). Among them, the most general method is realized by the regularization of the Newton kernels of the defining integrals of the field by the integration variable transformation to the local spherical polar coordinates (Fukushima 2016d, MNRAS, 463:1500–1517). If the object is of a certain simplified structure like being axially symmetric, and therefore is analytically integrable in one or two dimensions partially, useful is the employment of (i) the complete elliptic integrals, (ii) the split quadrature method, (iii) the double exponential rule, and (iv) the numerical differentiation: for an infinitely thin axisymmetric case (Fukushima 2016a, MNRAS, 456:3702–3714), for a general thick and axisymmetric body (Fukushima 2016c, MNRAS, 462:2138–2176; Fukushima 2017a, Comp. Phys. Comm., 221:109–117), for a general radially-unique finite object (Fukushima 2017b, AJ, 154:145), and for a spherical tesseroid (Fukushima 2018b, J. Geodesy, 92:1371–1386). Also, we developed a two-dimensional polygon method for an infinitely thin object (Fukushima 2016b, MNRAS, 459:3825–3860) and a recursive method for a rectangular prism with a vertical density profile following an arbitrary degree polynomial (Fukushima 2018a, Geophys. J. Int'l, 215:864–879). All these methods are capable to compute the gravitational potential, acceleration vector, and/or gravity gradient tensor accurately whether the evaluation point is inside, near the surface of, exactly on the surface of, and/or outside the object.