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Elena Kotevska* (elena.kotevska@tfb.uklo.edu.mk). *Real Earth Based Geopotential Determination*. Preliminary report.

For computational reasons, the spline interpolation of the Earth's gravitational potential is usually done in a spherical framework. However, the increasing observational accuracy require adequate mathematical methods and observing of the geophysically more relevant surfaces. In this work, we propose a spline method with respect to the real Earth surface. The spline formulation reflects the specific geometry of a given regular surface . This is due to the representation of the reproducing kernel as a Newton integral over the inner space of a regular surface. Moreover, the approximating potential functions have the same domain of harmonicity as the actual Earth's gravitational potential. This is a step forward in comparison to the spherical harmonic spline formulation involving functions harmonic down to the Runge sphere. It turns out that in the case of the spherical Earth, the representation of this kernel can be considered a kind of generalization to spherically oriented kernels. Keywords: , regular surface, reproducing kernel, harmonic function. (Received September 22, 2011)