



The oblate spheroidal harmonics under coordinate system rotation and translation

Georgios Panou

Department of Surveying Engineering, National Technical University of Athens, Zografou Campus, 15780 Athens, Greece
(geopanou@survey.ntua.gr)

Several recent studies in geodesy and related sciences make use of oblate spheroidal harmonics. For instance, the Earth's external gravitational potential can be mathematically expanded in an oblate spheroidal harmonic series which converges outside any spheroid enclosing all the masses. In this presentation, we develop the exact relations between the solid oblate spheroidal harmonics in two coordinate systems, related to each other by an arbitrary rotation or translation. We start with the relations which exist between the spherical harmonics in the two coordinate systems. This problem has received considerable attention in the past and equivalent results have been independently derived by several investigators. Then, combining the previous results with the expressions which relate the solid spherical harmonics and the solid spheroidal harmonics, we obtain the relations under consideration. For simplicity, complex notation has been adopted throughout the work. This approach is also suitable and easy to use in the zonal harmonic expansions. The spherical harmonics under coordinate system rotation and translation are obtained as a degenerate case. The above theory can be used in any spheroidal harmonic model. Finally, some simple examples are given, in order to illuminate the mathematical derivations.