

# On the spectral contribution of deep-seated mass distributions on the Earth's gravity field

- Degree:** Honours or M.Sc (by research)
- Keywords:** Physical geodesy, Gravity field, Forward gravity field modelling
- Entry:** For M.Sc: B.Surv, B.Sc(Catography), preferably 1st class Honours, Postgraduate Diploma
- Supervisor:** Dr.-Ing. Michael Kuhn ([M.kuhn@curtin.edu.au](mailto:M.kuhn@curtin.edu.au)), Western Australian Centre for Geodesy, Curtin University of Technology
- Project Funding:** Various
- Student Funding:** Different scholarships are available from Curtin University of Technology (<http://www.scholarships.curtin.edu.au/>).
- Resources:** Various sources on the Earth's mass distribution, software routines (in FORTRAN) to compute the gravitational effect of different shaped bodies and spherical harmonic analysis as well as synthesis.
- Collaboration:** None
- Starting Date:** Begin of each semester

## Project Description:

Nowadays, increasingly more information on the Earth's mass distribution is available. Apart from high-resolution information on the shape of the topographic masses (e.g. digital elevation models) more and more information on the deeper-seated mass anomalies such as isostatic compensation masses (e.g. information on the Moho) as well as mass anomalies in the mantle. Depending on the distance of such mass distributions different spectral signatures in the gravity field (e.g. effect on gravitational potential or gravity) at a computation point on or outside the Earth's surface will be produced. According to Newton's law, masses closer to the computation point, such as the topographic masses, produce more high-frequency information than that located deep inside the Earth. Equivalently, deep-seated masses have to be known with a coarser resolution than shallower masses in order to model their gravity field signal with the same precision by forward gravity field modelling. Therefore, information on the spectral contribution is essential in order to find the optimal spatial resolution of a certain mass distribution for forward gravity field modelling (Kuhn and Featherstone 2003).

This project studies the spectral contribution of deeper-seated mass distribution (below topographic masses) such as isostatic compensation masses and mass anomalies in the upper and lower mantle. For this study some synthetic mass distributions inside the mantle should be constructed to ensure that they include high spatial information. In order to study these effects the effect on potential can be expressed in spherical harmonics, thus the spectral contribution can be expressed in terms of degree variances (spectral power) (e.g. Rummel et al. 1988, Strang van Hees 2000, Kuhn and Featherstone 2003).

## Further Reading:

- Kuhn M, Featherstone WE (2003) On the optimal spatial resolution of crustal mass distributions for forward gravity field modelling. In Tziavos IN (ed): Gravity and Geoid 2002, 3<sup>rd</sup> Meeting of the International Gravity and Geoid Commission, Zitis Editions, Greece, 195-200.
- Rummel R, Rapp RH, Sünkel H (1988): Comparisons of global topographic/isostatic models to the earth's observed gravity field. Dept. Geod. Sci. and Surv., Ohio State University, Columbus, No. 388, 33 pp.

Strang van Hees GL (2000): Some elementary relations between mass distributions inside the Earth and the geoid and gravity field. *Journal of Geodynamics*, **29**:111-123.