Seminar title:

On the numerical computation of fields and field gradients from polyhedral gravitational and magnetic sources.

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Location:

ABSTRACT

In this talk I shall survey the development of closed form solutions to the gravitational potential, and of its gradients, for a polyhedral target. By Poisson's relation, this will include magnetic cases as well. Since the 1960's, many non-identical looking solutions have been proposed, and there is much duplication of effort found in the related disciplines of geophysics, celestial mechanics and geodesy.

I shall argue that desirable attributes in an anomaly solution for a polyhedral target include

1. coordinate-system independence (based on vectors and tensors);
2. similarity (links between solutions for the potential, field and field gradient);
3. low arithmetic complexity (leading to efficient code);
4. absence or flagging of singularities;
5. a priori numerical stability estimates (indication of the number of significant digits in the result).

I shall demonstrate that these goals can be realised for polyhedral targets of constant density.

Recently, there have been important advances in the gravity field formulae for polyhedra with the polynomial density contrast. I shall argue that the above 5 attributes also serve as guidelines for good practice in this development.

Finally, I shall illustrate specialisations of the general polyhedral theory, to two target cases, namely (1) thin polygonal sheets, and (2) 2D faults. The latter case has recently been treated, in a setting of great generality, by le Maire and Munschy.

References (to be cited in the seminar)

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