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Minimal energy interpolation of repeat orbit ground-track gaps

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If satellites of gravity-field missions are in an repeat orbit, their ground tracks do not sample the surface of the Earth uniformly, but leave large gaps. Usually, these gaps are interpolated by the representation of the gravitational field by surface spherical harmonics. Since surface spherical harmonics are algebraic/trigonometric polynomials, this interpolation tends to oscillate.
This contribution starts from the observation, that the gravitational field is best known along the ground tracks. Therefore, a reasonable interpolation strategy should fulfill two requirements:
i) Reproduce the measured values along the satellite tracks.
ii) Be as smooth as possible between the satellite tracks.
The concept of smoothness will be understood as the bending energy of an elastic membrane attached to the measured values along the satellite tracks. It will be shown, that such an interpolation is the solution of a boundary value problem for the biharmonic equation.
A finite difference approximation for the biharmonic equation is developed and numerically tested.
The biharmonic interpolation turns out to be more reasonable than the Gaussian smoothed spherical harmonics solution.