Joint inversion of spectroscopic data

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The application of inversion techniques to joint measurements of NIR and Raman spectra for the same reference data requires the development of joint inversion methodologies for the implementation of the calibration step. Joint inversion has been successfully utilized in geophysical prospecting and in medical diagnosis, where the need to perform calibration-and-prediction (CAP) is not involved. However, the obvious ways in which this might be achieved in spectroscopy, where some form of CAP must be performed, do not appear to work. In this talk, a new methodology, leap-frog CAP will be proposed, analysed and validated with synthetic and real data.

Perturbing flows for maximum chaotic mixing

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It is difficult to achieve good mixing in micro-fluidic devices, whose dimensions suppress turbulence. Motivated by this problem, the question of determining the best perturbing velocity field to improve mixing in an integrable flow is investigated. Though the optimisation problem when considered with a C^0-bound is ill-posed, it is shown that choosing the perturbation as close as possible to a certain (unphysical) flow generates the greatest chaotic flux across separatrices. This provides insight, for example, on the positioning of channels in cross-channel mixers, and the dependence of the flux on the perturbing frequency.

Series methods for atmospheric interfacial waves

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Recent developments in series solution methods for flow over topography mean that accurate solutions can be found very quickly. In this paper we use this speed to our advantage. We model the atmosphere as a two layer system with a lower layer of constant density and (in general) a compressible upper layer. The upper layer is assumed stationary. The condition that pressure be continuous across the interface between the layers results in differing forms for the Bernoulli equation depending on how the upper layer is modelled. We present solutions for three different forms of the upper layer. The first is a constant density layer, the second an isothermal upper layer and the last a constant lapse rate upper layer. The speed with which solutions can be found means that an investigation of the parameter space is far less time consuming than it might otherwise be.
