Bryce McLeod FRS FRSE Memorial Event

Lecture Room 3, Mathematical Institute, Oxford

Saturday 30 May 2015

John Toland (Isaac Newton Institute)

Title: The Fourier Series of Stokes Waves

Abstract: It is known that every positive solution of Nekrasov's integral equation gives a parametrization of the angle to the horizontal of a Stokes wave (a symmetric periodic wave with one crest and one trough per wavelength on deep water). A simple argument will be given to show that the Fourier sine coefficients of such a solution form a convex sequence. This observation arises from an elegant analytic continuation result that is proved using ordinary differential equations in complex plane in the spirit of Bryce Mcleod.

EN Dancer (University of Sydney and University of Swansea)

Title: Stable and finite Morse index solutions

We discuss stable and finite Morse index solutions of laplacian u=f(u) on half spaces or on all of n-dimensional space. We then discuss the application of these results to the study of stable or not too unstable solutions of laplacian u= r f(u) on D, u=0 on the boundary of D, where r is large and D is a bounded domain in n-dimensional space. We discuss positive results and numerous open problems.

Elaine Crooks (University of Swansea)

Title: Compensated convexity, Hausdorff-stable singularity extraction, and image processing

Abstract: Compensated convex transforms enjoy tight-approximation and locality properties that can be exploited to develop multi-scale, parametrised methods for identifying singularities in functions. These tools can then be used, via a numerical implementation, to detect features in images or data, remove noise from images, identify intersections between surfaces, etc, and thus produce new geometric techniques for image processing, feature extraction and geometric interrogation. Advantages of such an approach include the use of blind global methods that are Hausdorff-stable under perturbation and different sampling techniques, and are also multi-scale, providing scales for features that allow users to select which size of feature they wish to detect. This is joint work with Kewei Zhang, Nottingham, and Antonio Orlando, Tucumán.

Gero Friesecke (TU Munich)

Title: X-rays with a twist: solutions to Maxwell's equations yielding discrete diffraction patterns for helical structures

Abstract: Conventional X-ray methods use incoming plane waves and result in discrete structure-identifying diffraction patterns when scattered at crystals. Here we find, by a systematic method, incoming waveforms which exhibit analogously spectacular diffraction patterns when scattered at helical structures. If these waves can in the future be realized experimentally at X-ray wavelengths, it appears from our mathematical results that they will provide a promising tool for determining the detailed atomic structure of numerous nanostructures and biomolecules with helical symmetry, basic examples being nanotubes and filamentous viruses. This work makes contact with many of Bryce McLeod's interests: waves, electromagnetism, scattering, mathematical biology, ODE's, and vector fields with a "twist". This is joint work with Dominik Juestel (TU Munich) and Richard James (Minneapolis).

Oxford Centre for Nonlinear PDE