Colloquium

UNIVERSITY OF NOTRE DAME
Department of Mathematics

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4:15 PM
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Title: Linearity, nonlinearity and medical imaging

Abstract:

A new method for analyzing boundary value problems (BVPs) for linear and integrable nonlinear PDEs, extending ideas of the inverse scattering transform method, was introduced in [1] and further developed by several researchers. First,this method will be introduced by using linear evolution PDEs in the half-line as illustrative examples.Then,for the inegrable nonlinear analogues of these problems it will be emphasised that: (i)For linearizable BVPs the new method is as effective as the usual inverse scattering transform method; this includes PDEs with a third order derivative, for which the alternative approach of extension from the half-line to the full line, fails. (ii) For general (non-linearizable) BVPs, it yields the solution via a matrix Riemann- Hilbert problem, whose jump matrix can be characterized via a well defined nonlinear equation, in terms of the given initial and boundary conditions. (iii) For general BVPs, with either decaying, or t-periodic boundary conditions, it yields effective long time asymptotic formulae. Finally, the related development of the emergence of a new analytical approach to inverting integrals with applications in medical imaging, will be mentioned. [1] A S. Fokas, A Unified Transform Method for Solving Linear and Certain Nonlinear PDEs, Proc. R. Soc. Lond. A 453, 1411-1443 (1997).