Workshop on Solitons and Integrable Systems

Talk Titles and Abstracts

Title: On Linear and Nonlinear Dispersive Waves.

Dr. Lokenath Debnath,
University of Texas-Pan American

Abstract

Some linear and nonlinear dispersive wave models and their solutions will be discussed .

Title: Transformations among Nonlinear PDEs

Dr. Hongyou Wu
Northern Illinois University

Abstract

In this talk, we will first discuss a number of fundamental questions about Backlund transformations for and Miura transformations among Nonlinear PDEs, then review a couple of classification results about these transformations, and finally demonstrate a new Backlund transformation for the KdV equation that turns constant solutions into short range soliton-like solutions.

Title: Integrable decompositions of nonlinear Schroedinger equation

Dr. Ruguang Zhou
Xuzhou Normal University

Abstract

The nonlinearization of spectral problem has proved to be a very powerful technique for study of soliton equations. In this talk we shall give a complete treat for the integrable decompositions of the nonlinear Schroedinger equation by using binary nonlinearizations of spectral problems. Three kinds of finite dimensional integrable Hamiltonian systems are obtained. Their symplectic structure are discussed.

Title: The Generalized Weierstrass System and an Application to the Study of Deformations of Surfaces by Means of Integrable Hierarchies

Dr. Paul Bracken
University of Texas-Pan American

Abstract

Generalized Weierstrass Representations are introduced and shown to be useful in investigating deformations of surfaces under the action of an integrable hierarchy.

Title: A short pulse model equation and its multi-soliton solution

Dr. Baofeng Feng
University of Texas-Pan American

Abstract

Most recently, a short pulse (SP) equation was derived from the Maxwell equation to describe the propagation of ultra-short optical pulses in nonlinear media. It is argued that the SP equation is a better approximation than the NLS equation. In the talk, I will firstly review the results regarding the integrability and the multi-solition solutions of the SP equation by other authors. Then I will discuss the further topics of the SP equation.

Title: Determinant Techniques for Soliton Equations

Dr. Wen-Xiu Ma
University of South Florida

Abstract

Wronskian and Casoratian type determinants are used to solve soliton equations. The resulting techniques are applied to the Korteweg-de Vries equation, the Toda lattice equation and the Volterra lattice equation, and their corresponding Hirota's bilinear equations are transformed into the pluecker relations. Solitons, positions and complexitons are thus generated from Wronskian and Casoratian type determinants.

Title: Soliton interactions of two dimensional vector soliton systems

Dr. Kenichi Maruno
University of Texas-Pan American

Abstract

Recently, vector (or coupled) soliton equations such as the vector nonlinear Schrodinger (vNLS) equation have received much attention in mathematical physics and nonlinear physics. The vNLS equation has been especially studied from both mathematical and physical points of view. It was also pointed out that vector solitons can be used in the construction of logic gates. Although there are many works on one-dimensional (1D) vector solitons, a mathematical picture of two-dimensional vector solitons is still missing. The study of two-dimensional (2D) vector solitons is important for a more complete understanding of the mathematical structure of vector solitons. Here I will discuss 2D vector long wave-short wave (LS) interaction systems in some physical settings. The 1D LS interaction system was derived by Yajima and Oikawa as a model of interactions between long ion-acoustic waves and short Langmuir waves in plasma, and describes the interaction between KdV-type long waves and NLS-type short waves. Recently, the 1D LS interaction system also appeared in the study of Bose-Einstein condensates. The 1D LS interaction system is integrable by means of the inverse scattering transform. Here I will show that a two-dimensional and vector generalization of the long wave-short wave interaction system exists in some physical settings. The model is integrable for certain choices of parameters. I will also present the Wronskian form of soliton solutions of the 2D vector LS interaction system and discuss the properties of soliton interactions.

Title: Integrable cuspon and peakon equations

Dr. Zhijun (George) Qiao
University of Texas-Pan American

Abstract

In my talk, I will give brief introduction on some peaked soliton equations and present a basic approach to get peaked and cusped soliton solutions. Those equations include the well-known Camassa-Holm(CH), the Degasperis-Procesi (DP), and other new peaked soliton equations. Interesting thing is that an integrable equation may have no classical smooth solitons. In the talk, I will illustrate this feature through two new integrable equations that I found recently. Later, I take the CH case as a typical example to show how we obtain the peaked solitons and the parametric solutions.