Mathematics Seminar

Sponsored by the Department of Mathematics
Florida Gulf Coast University

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Control of residual error in the Optimal Homotopy Analysis Method

The Homotopy Analysis Method is an innovative new (Liao, 1992) way to get analytical solutions to nonlinear differential equations. We begin with a brief introduction to the concept of homotopy from topology.

From there, the Homotopy Analysis Method is discussed in detail. We describe how the idea of homotopy is applied to introduce a parameter into ordinary/partial differential equations that do not have one to begin with.

The homotopy between a linear operator and a nonlinear operator allows us to use perturbation on this parameter to obtain analytical solutions to these equations with small error.

The idea is applied to a nonlinear sigma-model where we can explicitly calculate the sum of squared residual error, and then to an equation governing the nonlinear evolution of a vector potential of an electromagnetic pulse propagating in an arbitrary pair plasma with temperature asymmetry.

In the latter, the sum of squared residual error is more difficult to integrate, so different techniques have to be used to perform calculations on the residual error.

Finally, we turn to partial differential equations and look at the Hasegawa-Mima equation, a very difficult equation that governs the electric potential due to a drift wave in a plasma.

Future work is discussed, including applying the method to more PDEs, the stability of the error with the choice of the auxiliary linear operator, and how the convergence control parameter changes with respect to the error function chosen.

Thursday, April 24th, 2014

2:00 pm – 3:00 pm

Library Room 443

Light Refreshments will be available