Oberseminar Nichtlineare Differentialgleichungen

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On Traveling Waves for the Fractonal KP-I Equation

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Abstract:

In this talk, I will discuss some recent results and ongoing work concerning traveling waves for the fractional KP-I equation

$$(*) \qquad (u_t + uu_x - D^\alpha u_x)_x - u_{yy} = 0.$$

For $\alpha = 2$ one recoveres the classical KP-I equation, which was introduced by Kadomtsev & Petviashvili as a weakly two-dimensional extension of the Korteweg–de Vries (KdV) equation. Similarly as in the classical case, the fractional KP-I equation is a two-dimensional extension of the fractional KdV equation.

Trivially, any solitary solution of the fractional KdV equation is a solution of the fractional KP-I equation – called the *line solitary solution*. It is known that the line solitary solution for the classical KP-I equation is transversely linear and nonlinear unstable (Zakharov '73; Alexander, Pego, Sachs '97; Rousset, Tzvetkov '09, Rousset, Tzvetkov '07). Relying on a simple criterion posed by Rousset & Tzvetkov in 2013, we extend the result on transverse linear instability for the fractional KP-I equation. Numerical experiments support the instability result for the fractional KP-I equation and suggest transverse stability for the fractional KP-II equation (which is given by $(*)$ when repacing $-u_{yy}$ by $+u_{yy}$). Furthermore, we discuss the existence and properties of fully localized solitary solutions for the fractional KP-I equation.

The results are based on joint works with H. Borluk (Istanbul) and D. Nilsson (Lund).

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