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Long-time behaviour for nonlocal problems

Liviu Ignat,
Simion Stoilow Institute of Mathematics, Bucharest

In this talk we will present some nonlocal evolution problems that involve operators of the type:

$$Lu(x) = \int_{\mathbf{R}^d} J(x-y)(u(y)-u(x))\,dy$$

We analyze the asymptotic behaviour of the solutions of the following nonlocal convection-diffusion equation

$$u_t = J \ast u - u + G \ast (|u|^{p-1}u) - |u|^{p-1}u.$$

Firstly we present various methods to obtain the decay of the solutions. Secondly we analyze the first term in the asymptotic expansion of the solutions. These results are mainly obtained by scaling arguments and a new compactness argument that is adapted to nonlocal evolution problems.

Friday, April 17, 2015
10:00-11:00 am
C-210

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Dispersion property for Schrödinger equations

Liviu Ignat,
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The solutions of the Schrödinger equation on the whole line

$$\begin{cases} iu_t + u_{xx} = 0, & x \square \mathrm{R}, t \square \mathrm{R}, \\ u(0, x) = \square(x), & x \square \mathrm{R}, \end{cases} \tag{1}$$

can be written as

$$u(t) = S(t)\square \quad \frac{e^{i|x|^2/4t}}{(4\pi i t)^{1/2}} \square \square.$$

There are two properties that follow from the above representation. The first one is the conservation of the $L^2(\mathrm{R})$ norm:

$$lS(t)\square l_{L^2(\mathrm{R})} = l\square l_{L^2(\mathrm{R})}. \tag{2}$$

The second one is the so-called *dispersive* property, which shows that the solutions of system (1) decay as time increases:

$$lS(t)\square l_{L^\infty(\mathrm{R})} \leq \frac{1}{(4\pi|t|)^{1/2}} l\square l_{L^1(\mathrm{R})}. \tag{3}$$

These simple properties can be used to obtain more refined estimates for the linear semigroup. There are properties of gain on integrability/regularity with respect to the initial data: the Strichartz estimates and the so-called local smoothing property, both of them having an important role in solving nonlinear problems. In this talk we analyze the dispersion property (3) in the context of discrete equations and of the equations on graphs.

Friday, April 24, 2015
10:00-11:00 am
C-210