Exponential stability and analiticity of semigroups related to operator models in hydrodynamics and elasticity

A.A. Shkalikov

Linearized equations that appear in different areas of mechanics can be often written in the operator form

$$\ddot{x} + B\dot{x} + A\,x = 0$$

where A and B are operators in Hilbert space H. Commonly $A = A^* > 0$ and B is accretive in H.

The problem is to find additional conditions on A and B which guarantee the exponential decaying of the energy of the solution

$$E(t) = \frac{1}{2}(||\dot{x}||^2 + ||A^{1/2}x||^2)$$

This problem leads to the investigation of the semigroup generated by the operator

$$\begin{pmatrix} 0 & I \\ -A & -B \end{pmatrix} \qquad \text{in } H \times H_1$$

where H_1 is the space with the norm $||x||_1 = (A^{1/2}x, A^{1/2}x)$. There are papers of G.Chen, F.Huang, D.Rassel, R.Triggiani which give sufficient conditions of the analiticity of this semigroup. We essentially relax these conditions and find a "minimal" condition for the exponential stability.

The talk is based on the joint work with R.Hryniv.