Stefano Maset

Dipartimento di Matematica e Informatica, Università di Trieste
maset@units.it

Numerical approximation of characteristic values of Partial Retarded Functional Differential Equations

The stability of an equilibrium point of a dynamical system is determined by the position in the complex plane of the so-called characteristic values of a linearization around the equilibrium.

This talk presents an approach for the numerical computation of characteristic values of semi-linear partial differential equations of evolution involving time delay, restated as abstract linear retarded functional differential equations

$$\frac{dv(t)}{dt} = A_T v(t) + L v_t,\ t \geq 0,$$

where $v\,(t)$ belongs to a Banach space X, A_T is the infinitesimal generator of a C_0-semigroup on X, v_t is the function

$$v_t\,(\theta) = v\,(t+\theta)\,,\ \theta \in [-r, 0]\,,$$

belonging to the space $\mathcal{C}$ of the continuous functions $[-r, 0] \to X$ and $L : \mathcal{C} \to X$ is a linear bounded functional.

The numerical approach is a combination of a pseudospectral method for the discretization of functions defined in $[-r, 0]$ with a spectral method for the discretization of X. The convergence of the approximated characteristic values to the exact ones is of infinite order with respect to the pseudospectral discretization and only of finite order with respect to the spectral discretization. However, for one dimensional reaction diffusion equations, the finite order of the spectral discretization is so high that the convergence turns out to be as fast as one of infinite order.

This is a joint work with Dimitri Breda and Rossana Vermiglio from Dipartimento di Matematica e Informatica, Università di Udine.