# Topological methods for semi-linear evolution equations in abstract spaces

Luisa Malaguti
Department of Engineering Sciences and Methods, University of Modena and Reggio Emilia, Italy
luisa.malaguti@unimore.it

This talk deals with a semi-linear evolution equation $x'(t) = Ax(t) + f(t, x(t))$ in a Banach space. Its interest derives from the fact that it is the abstract formulation of many concrete differential models. We assume that the densely defined linear part $A$ generates a strongly continuous semigroup $\mathcal{S}(t)$, $t \geq 0$. Various regularity properties for the nonlinear term $f$ are considered. The case when $f$ has a super-linear growth in $x$ is always included.

The associated two-point boundary value problem (b.v.p.) in $[0, T]$, i.e. $Mx(0) + Nx(T)$ with $M$ and $N$ linear and bounded, is investigated, mainly by means of topological techniques. The introduction of suitable guiding-like functions for guaranteing the required transversality is new, in this context. Both the special cases when $A$ generates a contraction semigroup and when $\mathcal{S}(t)$ is compact for $t > 0$ are showed.

Concrete examples of guiding-like functions are proposed when $\mathcal{S}(t)$ is the translation semigroup and for the Laplacian operator.

Some non-local b.v.p. such as the multi-point Cauchy problem are discussed as well, with similar techniques.

Applications to the study of possibly non-local population diffusion models complete this presentation.

*References*

[1] *J. Andres, L. Malaguti, V. Taddei*: On boundary value problems in Banach spaces. Dyn. Syst. Appl. *18* (2009), 275–302.

[2] *I. Benedetti, L. Malaguti, V. Taddei*: Two-point b.v.p. for multivalued equations with weakly regular r.h.s. Nonlin. Anal. *74* (2011), 3657–3670.

[3] *L. Malaguti*: A guiding-like function approach in abstract spaces, preprint.