Semilinear evolution equations without strong compactness: solvability and controllability

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We consider a semilinear multivalued evolution equation in a Banach space. We investigate the problem in the space of continuous functions endowed with the weak topology, hence no strong compactness is assumed, neither on the evolution operator generated by the linear part, nor on the nonlinear term. In the first part of the talk, we study the existence of mild solutions for a wide family of nonlocal associated boundary value problems, which have better application in physics than the classical initial problem (see [1]). In the second part of the talk, we study the exact controllability of the problem. With our approach, we are able to avoid the requirement of the compactness of the evolution operator generated by the linear part, which turns out to be in contradiction with the exact controllability in infinite dimensional spaces (see [2]). We use both fixed point techniques and the degree theory for condensing multivalued operators. Applications are given to partial integro-differential equations arising in population diffusion and age-structure population models.

References

[1] *I. Benedetti, L. Malaguti, V. Taddei*: Nonlocal semilinear evolution equations without strong compactness: theory and applications, will appear on the special issue of Bound. Value Probl. dedicated to Jean Mawhin's Achievements in Nonlinear Analysis.

[2] *I. Benedetti, V. Obukhovskii, V. Taddei*: Exact controllability for systems governed by semilinear evolution equations without compactness, in preparation.