

SEMINÁRIO DE ANÁLISE E EQUAÇÕES DIFERENCIAIS

Dia 8 de Novembro (quinta-feira), às 13h30, na sala 6.2.33

Global attraction in delay differential equations: a link with difference equations

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Abstract:

Delay differential equations (DDEs) are a tool to model phenomena whose evolution depends on their past behaviour. In particular, these equations can be used for modelling population or economic growth, neural networks, etc. Once a differential model is formulated, a main question is how its solutions behave. In particular, do they tend to a certain value as time goes by? One of the main difficulties of working with qualitative theory of DDEs with positive delays is that the phase space is an infinite-dimensional Banach space: initial conditions must include the states in a certain interval of time in the past [2]. Therefore, the analysis of the behaviour of solutions requires a bigger effort. In this talk, we will introduce DDEs and some of their basic properties. Then, we will explain how the dynamics of a scalar DDE can be “inherited” from the dynamics of a scalar difference equation [3] and why the latter is, in some cases, easier to study. We will also explain how this link can be extended to the multidimensional case [4]. Finally, we will show concrete applications where this technique applies [1, 4].

References

- [1] S. Buedo-Fernández, E. Liz. On the stability properties of a delay differential neoclassical model of economic growth, *Electron. J. Qual. Theory Differ. Equ.* (2018) No. 43, 1–14.
- [2] J. K. Hale, S. M. Verduyn Lunel, *Introduction to functional differential equations*. Springer-Verlag, New York, 1993.
- [3] A. F. Ivanov, A. N. Sharkovsky. Oscillations in singularly perturbed delay equations, *Dynam. Report. Expositions Dynam. Systems (N.S.)* 1 (1992), 164–224.
- [4] E. Liz, A. Ruiz-Herrera. Attractivity, multistability, and bifurcation in delayed Hopfield’s model with nonmonotonic feedback, *J. Differential Equations* 255 (2013), 4244–4266.

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