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Preface

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Delay-differential equations (DDEs) are often used in different fields of science. In some sense, they form an intermediate model with reduced number of parameters between partial differential equations (PDEs) and ordinary differential equations (ODEs). Similarly to PDEs, DDEs are infinite dimensional, but with a different physical meaning. While for PDEs, the infinite-dimensional dynamics is related to the continuum of solid bodies or fluids represented by spatial coordinates, the infinite-dimensional nature of the DDE is due to the presence of the past effects, described by functions embedded also in the time domain above the past interval $[t - \sigma, t]$, where σ denotes the length of the delay effect. Although the complexity inherited from its infinite-dimensional nature presents a rich dynamics, it is often possible to get illustrative analytical results. These properties make DDEs more and more popular in different fields ranging from biology through chemistry to physics and engineering.

It is commonly known that time delay tends to destabilize the equilibria of any dynamical system and also, time delay tends to make the corresponding bifurcations subcritical at the limits of linear stability. This often leads to complex structures of unstable periodic and quasi-periodic solutions in the phase space, and consequently, chaos may easily appear in the jungle of these orbits. This is a simple way to recognize the richness of the dynamics of delayed systems.

Not surprisingly, many delay-related papers have been submitted to International Journal of Dynamics and Control. These are organized into two thematic issues. In the first issue, 10 papers are collected. The topics include delayed feedback control in networks, stability predictions for machining operations, vibration suppression via delayed absorber, delayed control of continuum beams, and optimization algorithms for sampled-data control systems with delay.

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