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Canard cycles in predator-prey models and bifurcation of degenerate graphics for Hilbert's 16th Problem

In this talk, I will start with a classical predator-prey type of system to present the limit cycles and their bifurcations, including canard cycles (fast-slow oscillations) and their cyclicity as well as fast-slow dynamics. Lately, we realize that there are two different types of degenerate limit periodic sets which can generate limit cycles in the predator-prey systems with Holling types of function response. I will then use the simple model with Holling type II functional response to present the two mechanisms for the fast-slow dynamics. In the end, I will connect the finiteness part of Hilbert's 16th problem for quadratic vector fields to explain the difficulties in dealing with the finite cyclicity of a degenerate graphics, the last challenge towards the proof of the finiteness part of Hilbert's 16th problem for quadratic vector fields.