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Global asymptotical stability in polynomial planar vector fields

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Abstract

The analysis of global asymptotical stability is a fundamental topic within the qualitative theory of dynamical systems. The existence of a unique equilibrium point that attracts all trajectories as time progresses, regardless of the initial state, guarantees a well-defined and predictable long-term behavior. This is of special relevance in some disciplines as for example biology, population dynamics, and the mathematical modeling of social and economical processes.
Over the years, due to its theoretical and practical significance, numerous authors have addressed the study of global asymptotical stability. A wide range of approaches have been proposed, including Lyapunov-based approaches, geometric methods, and topological tools. However, despite significant progress, these methods often present important theoretical and practical difficulties, such as restrictive assumptions or challenges in their explicit implementation.
For this reason, the search for alternative criteria and new characterizations applicable to nonlinear systems continues to be a rich and active line of research. Here we present some works in which we have characterized some polynomial planar cubic systems, determining all the necessary and sufficient conditions for the asymptotic stability [1, 2, 3]. We will explain the qualitative tools employed in the proofs, as compactification methods and desingularization techniques of blow-up type.

References

[1] Diz-Pita, É.; Otero-Espinar, M. V.; Valls, C. Global asymptotic stability in cubic systems with a nilpotent point at the origin and with an invariant straight line, Qualitative Theory of Dynamical Systems, 24(175), 2025.

[2] Diz-Pita, É.; Otero-Espinar, M. V.; Valls, C. Global asymptotic stability in Cherkas systems, preprint, 2026.

[3] Diz-Pita, É. Global asymptotic stability in Kolmogorov systems characterizing Lotka-Volterra tridimensional systems, preprint, 2026.

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