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9. Ordinary Differential Equations and Dynamical Systems

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Global bifurcation theory and multiple limit cycles

Two-dimensional polynomial dynamical systems are considered. Their global bifurcation theory is developed by means of Erugin's two-isocline method, canonical systems with field-rotation parameters, and Perko's termination principle stating that the maximal one-parameter family of multiple limit cycles terminates either at a singular point, which is typically of the same multiplicity, or on a separatrix cycle, which is also typically of the same multiplicity. Applying the termination principle and using the data on the cyclicity of singular points and separatrix cycles, we establish by contradiction a dependence of the multiplicity number of limit cycles from the number of field-rotation parameters in the system and develop a new approach to the solution of Hilbert's 16th problem.