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Qualitative Theory of Dynamical Systems

Hilbert's Sixteenth Problem for Polynomial Liénard Equations

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Abstract This article reports on the survey talk 'Hilbert's Sixteenth Problem for Liénard equations,' given by the author at the Oberwolfach Mini-Workshop 'Algebraic and Analytic Techniques for Polynomial Vector Fields.' It is written in a way that it is accessible to a public with heterogeneous mathematical background. The article reviews recent developments and techniques used in the study of Hilbert's 16th problem where the main focus is put on the subclass of polynomial vector fields derived from the Liénard equations.

Keywords Planar vector fields · Periodic orbits · Compactification · Large amplitude limit cycles · Liénard equations

Mathematics Subject Classification (2000) Primary 34C07; Secondary 37G15 · 34C20

1 Introduction

Polynomial Liénard equations are planar differential equations associated to the second order scalar differential equations

$$x'' + f(x)\,x' + g(x) = 0, \tag{1.1}$$

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