Limit Cycles, Abelian Integrals and Hilbert's 16th Problem

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Resumo/Abstract:

The main in this course is to introduce to reader with some problems arising from the centennial Hilbert 16^{th} Problem. The second part of this problem, asking for the maximum H(n) of the number of limit cycles and their relative positions for all planar polynomial differential systems of the degree n, is still open even for the quadratic case (n=2). The infinitesimal version (weak form) of this problem, proposed by Arnold, asking for the maximum of the numbers of isolated zeros of Abelian integrals of all polynomial 1-form of degree n over algebraic ovals of degree m, is also hard to study. Our aim is not to collect all the developments and theorems in direction of this problem, but to present a way of breaking the problem in many pieces and observing the fact that even such partial problems are extremely difficult to treat. Our point of view is algebraic and we want to point out that the both real and complex algebraic geometry would be indispensable for a systematic approach to the Hilbert's 16^{th} problem.

Pré-requisitos: Basic notions in differential equations, linear algebra and algebraic geometry