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Section:

9. Ordinary Differential Equations and Dynamical Systems

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Scárdua, Bruno, Instituto de Matemática Pura e Aplicada, Brazil

Integration of Complex Differential Equations

Let $\mathcal{F}$ be an algebraic foliation admitting a Liouvillian first integral on $\mathbb{C}P(2)$. Then $\mathcal{F}$ is transversely affine outside some algebraic invariant curve $S \subset \mathbb{C}P(2)$. If moreover for some irreducible component $S_0 \subset S$ the singularities $q \in \mathrm{Sing}\mathcal{F} \cap \mathrm{S}$ are nondicritical and generic then either $\mathcal{F}$ is given by a closed rational 1-form or it is a rational pull-back from a Riccati foliation $\mathcal{R}$: $p(x)dy - (y^2a(x) + yb(x))dx = 0$ on $\overline{\mathbb{C}} \times \overline{\mathbb{C}}$. The result applies on the study of foliations with algebraic limit sets on $\mathbb{C}P(n)$, on the classification polynomial complete vector fields over $\mathbb{C}^2$, and topological rigidity of foliations on $\mathbb{C}P(2)$.

Reference: B. Scárdua: Transversely affine and transversely projective holomorphic foliations. Ann. Sc. E. N. S., **t.30** (1997), 169-204.