

# On Fuchsian equations with a small parameter before the highest derivative

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Parametric families of ordinary differential equations with a small parameter occurring before the highest derivative are notorious for their malicious behavior. Generically referred to as "singular perturbations", they exhibit all kinds of complicated behavior, both analytically and dynamically: canard limit cycles, exponential and super-exponential asymptotics, ultrafast oscillations, divergence of different formal analytic procedures e.a. Many methods were developed, both by classics and more recently, to deal with such challenges.

However, for some equations we have an a priori qualitative information that their solutions exhibit relatively tame behavior despite the fact that formally the equations "look dangerously". In my talk I will explain how this qualitative information can be transformed into explicit quantitative results on solutions of these equations. The results are remotely resembling the "removable singularity" theorems from the classical complex variables theory. The result has direct implications for the Infinitesimal Hilbert 16<sup>th</sup> problem on zeros of Abelian integrals.