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Sinopsis

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Presents a comprehensive theory of infinite composite asymptotic expansions (CAEs), an alternative to the method of matched asymptotic expansions

Generalizes the classical theory of Gevrey asymptotic expansions to such CAEs, thus establishing a new powerful tool for the study of turning points of singularly perturbed ODEs

Using CAEs, especially their versions of Gevrey type, to obtain new results for three classical problems in the theory of singularly perturbed ODEs

The purpose of these lecture notes is to develop a theory of asymptotic expansions for functions involving two variables, while at the same time using functions involving one variable and functions of the quotient of these two variables. Such composite asymptotic expansions (CAEs) are particularly well-suited to describing solutions of singularly perturbed ordinary differential equations near turning points. CAEs imply inner and outer expansions near turning points. Thus our approach is closely related to the method of matched asymptotic expansions. CAEs offer two unique advantages, however. First, they provide uniform expansions near a turning point and away from it. Second, a Gevrey version of CAEs is available and detailed in the lecture notes. Three problems are presented in which CAEs are useful. The first application concerns canard solutions near a multiple turning point. The second application concerns so-called non-smooth or angular canard solutions. Finally an Ackerberg-O'Malley resonance problem is solved.

Content Level » Research

Keywords » Gevrey expansions - composite asymptotic expansion - ordinary differential equation - singular perturbation - turning point

Related subjects » Analysis - Dynamical Systems & Differential Equations