

## Asymptotic analysis

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**Abstract:** The theory of asymptotic analysis is an important subject of applied mathematics, with a fairly long history and a strong promise for continued important applications throughout science. This theory has applications in several branches as Astronomy, Fluid dynamics or Homogenization, and, in general, it is especially useful to construct approximate solutions to ordinary differential equations (ODEs) and partial differential equations (PDEs) with a small parameter. In these lectures we will first present the history of asymptotic analysis, the basic techniques, and the method of matched asymptotic expansions. Then we will give some examples from the theory of ODEs and PDEs.

### Program:

1. History and basic tools
2. Regular and singular perturbations
3. Matched asymptotic expansions, with applications to ODEs
4. Applications to PDEs

### References:

- [1] J. Cole. *Perturbation Methods in Applied Mathematics*. Blaisdell, Waltham, MA, 1968.
- [2] L. E. Fraenkel. On the method of matched asymptotic expansions, *Proc. Camb. Phil. Soc.* **65** (1969). Part I: A matching principle, 209–231. Part II: Some applications of the composite series, 233–261. Part III: Two boundary-value problems, 263–284.
- [3] E. J. Hinch. *Perturbation Methods*. Cambridge University Press, 1991.
- [4] M. Holmes. *Introduction to Perturbation Methods*. Springer Verlag, New York, 1995.
- [5] A. M. Il'in. *Matching of Asymptotic Expansions of Solutions of Boundary Value Problems*. Translations of Mathematical monographs, Vol. 102. American Math. Society, Providence, RI, 1992.
- [6] W. Eckhaus. *Matched Asymptotic Expansions and Singular Perturbations*. North-Holland Mathematics studies, Vol. 6. Amsterdam, 1973.