Chapter 4
Introduction

Regradless of which phenomena involving high-frequency oscillations or heterogeneities one is dealing with, their simulations all face the same problem: when one tries to simulate the phenomena directly, even with a numerical method that is very efficient when no oscillations occur, one has to use a discretization step much smaller than the typical size of the high-frequency oscillations. This makes the cost of the simulation extremely high.

It is possible, inspired by the two-scale convergence, to build numerical methods which account for oscillations or heterogeneities in their design.

In this part, I give two examples of such so-called two-scale numerical methods.

The domain of applicability of the two-scale numerical methods considered here consists of phenomena that involve an oscillation or a heterogeneity that occurs at only one small scale, is periodic, and is relatively easy to describe.

I am convinced that this kind of methods can be generalized to phenomena involving more complex oscillations or heterogeneities incorporating in them concepts from homogenization methods that are more sophisticated than two-scale convergence.

E. Frénod, *Two-Scale Approach to Oscillatory Singularly Perturbed Transport Equations*, Lecture Notes in Mathematics 2190,
DOI 10.1007/978-3-319-64668-8_4