Preface

For my Ph. D. thesis, I was concerned with modeling deformation twinning in single crystals. These are shear bands of varying thicknesses and fixed orientation with respect to the crystal lattice. To obtain effective, macroscopic stress-strain relations, I used a periodically repeated cubic unit cell that covered some 30 grains. I soon realized that the ability of the unit cell to accommodate deformation twins depends on the alignment of the periodicity frame with the crystal orientations, which affects the effective material response. This erroneous orientation dependence raised my curiosity about homogenization methods. Without being aware of the vastness and complexity of the subject, I started exploring it.

After teaching homogenization methods for several years, the lecture notes matured into the German edition of this book, of which this is an updated translation. I have included many minor corrections and a few additional sections.

The book covers a wide range of homogenization methods for linear problems. I did my best to maintain a complete overview and point out the connections between different approaches.

To check for myself whether I have understood something, I found it helpful to implement it as a computer program. Gaps and errors in reasoning emerge mercilessly when putting them into an algorithm. As a result, the book contains many listings of Mathematica notebooks,[1] which may be useful for practitioners.

This book cannot be digested without a firm basis in continuum mechanics and tensor calculus.

1 Available at https://gitlab.com/gluegerainer/listings-homogenization-methods

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