

Preface

This book has a rather long and complicated history. One of the authors, Louis Michel, passed away on the 30 December, 1999. Among a number of works in progress at that time there were a near complete series of big papers on “Symmetry, invariants, topology” published soon after in Physics Reports [75] and a project of a book “Lattice geometry”, started in collaboration with Marjorie Senechal and Peter Engel [53]. The partially completed version of the “Lattice geometry” by Louis Michel, Marjorie Senechal and Peter Engel is available as a IHES preprint version of 2004. In 2011, while starting to work on the preparation of selected works of Louis Michel [19] it became clear that scientific ideas of Louis Michel developed over the last thirty years and related to group action applications in different physical problems are not really accessible to the young generation of scientists in spite of the fact that they are published in specialized reviews. It seems that the comment made by Louis Michel in his 1980’s talk [70] remains valid till now:

“Fifty years ago were published the fundamental books of Weyl and of Wigner on application of group theory to quantum mechanics; since, some knowledge of the theory of linear group representations has become necessary to nearly all physicists. However the most basic concepts concerning group actions are not introduced in these famous books and, in general, in the physics literature.”

After rather long discussions and trials to revise initial “Lattice geometry” text which require serious modifications to be kept at the current level of the scientific achievements, it turns out that probably the most wise solution is to restrict it to the basic ideas of Louis Michel’s approach concentrated on the use of group actions. The present text is based essentially on the preliminary version of the “Lattice geometry” manuscript [53] and on relevant publications by Louis Michel [71, 76, 72, 73, 74], especially on reviews published in Physics Reports [75], but the accent is made on the detailed presentation of the two- and three-dimensional cases, whereas the generalization to arbitrary dimension is only outlined.

