Preface

The study of measure-valued solutions of partial differential equations (PDEs in the sequel) combines two distant mathematical areas, measure theory and theory of PDEs. Since measure-valued solutions describe singularities of solutions of PDEs, a subject related to the concept of capacity, fundamental results of potential theory also appear in the discussion.

As a consequence, gathering from the literature what is needed for the study is often difficult. In books devoted to PDEs, often the results of measure theory (e. g., on Young measures) that are strictly necessary for applications are presented, to the detriment of the understanding of the theory as a whole. On the other hand, books on measure theory and probability frequently use terminology and arguments unfamiliar to the PDE scholar, while aspects related to the analytic functional framework remain in the background. To some extent, similar remarks apply to treatises on potential theory.

This book is aimed at presenting the topics mentioned above in a unified framework; analytical methods of proof are mostly used, and general aspects of functional analysis are highlighted. It is written for a wide range of possible interested parties, including the students and advanced mathematicians. Being self-contained, it is also intended both for self-study and as a reference book for well-known and less well-known things. The reader is expected to have a background in real analysis, topology, and functional analysis at the level of textbooks like [90]. Anyway, necessary preliminaries on topology are recalled in Appendix A at the end of the book.

A detailed description of the contents of the chapters is given at the beginning of each part. We do not consider it useful to suggest specific paths to the reader, who will proceed for himself according to his own taste and interests.

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