

How to Use This Book

This book is addressed to both mathematicians and physicists interested in the subject. We want to address young students and researchers at the master or graduate level. But the book should be helpful to the senior researcher as well.

The book is divided into four parts, each consisting of several chapters. Part I provides the necessary physical and mathematical preliminaries. Here the presentation is quite brief, and we refer to the standard textbooks for more details. We selected the material with the focus on what is most essential for causal fermion systems. We also introduce the conventions and notations that will be used later in the book. The content of Chapter 4 can be omitted by a reader who wants to concentrate on systems without gravity in Minkowski space.

Part II, introduces the main concepts and structures. In Chapter 5, we motivate and define causal fermion systems and explain the fundamental structures. This chapter is essential for all the later parts of the book and should be read first. In Chapters 6–11 of Part II, the structures of a causal fermion system are explained in more detail, also setting the state for the later analysis.

In Part III, we introduce the mathematical methods for the analysis of causal fermion systems. The different methods can be understood as a toolbox, from which the reader may choose depending on her interests and needs. The chapters in this part are self-contained, except for obvious dependencies (e.g., the energy methods for the linearized field equations in Chapter 14 build on similar methods for symmetric hyperbolic systems in Chapter 13). We note that the methods presented in this book are by no means exhaustive; we concentrate on the main methods that have been fruitful so far.

Part IV provides additional examples and gives an outlook on the physical applications. Here the presentation is a bit more sketchy than in Parts II and III. The reason is that, after being familiar with Parts II and III of the present book, the reader should be well prepared for delving into the research articles. Moreover, the content of Chapter 21 is covered in detail in the textbook [45]. Therefore, the purpose of this chapter is merely to give a nontechnical overview. The content of Chapter 22, on the other hand, is a field of active research. Therefore, it seems preferable to present this material systematically and in more detail at a later stage in a separate textbook.

Every chapter is supplemented by a section with exercises. Studying these exercises is important for getting familiar and deepening the understanding of the material. Hints on how to solve the problems should simplify the self-study.

We finally note that supplementary course material and video lectures are available online via the book's webpage at www.cambridge.org/9781009632621

We hope that the reader will enjoy reading and learning from this book. Feedback is always welcome.