Grubb

Distributions and Operators

This textbook gives an introduction to distribution theory with emphasis on applications using functional analysis. In more advanced parts of the book, pseudodi?erential methods are introduced. Distributiontheoryhasbeen developedprimarilytodealwithpartial(and ordinary) di?erential equations in general situations. Functional analysis in, say, Hilbert spaces has powerful tools to establish operators with good m- ping properties and invertibility properties. A combination of the two allows showing solvability of suitable concrete partial di?erential equations (PDE). When partial di?erential operators are realized as operators in L (?) for 2 n anopensubset?ofR ,theycomeoutasunboundedoperators.Basiccourses infunctionalanalysisareoftenlimitedtothestudyofboundedoperators,but we here meet the necessityof treating suitable types ofunbounded operators; primarily those that are densely de?ned and closed. Moreover, the emphasis in functional analysis is often placed on selfadjoint or normal operators, for which beautiful results can be obtained by means of spectral theory, but the cases of interest in PDE include many nonselfadjoint operators, where diagonalizationbyspectraltheoryisnotveryuseful.Weincludeinthisbooka chapter on unbounded operatorsin Hilbert space (Chapter 12),where classes of convenient operators are set up, in particular the variational operators, including selfadjoint semibounded cases (e.g., the Friedrichs extension of a symmetric operator), but with a much wider scope. Whereas the functional analysis de?nition of the operators is relatively clean and simple, the interpretation to PDE is more messy and complicated.

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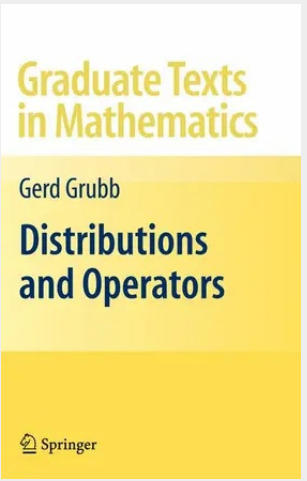

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