
Preface

This book is the new edition of the original two-volume book, published in 1994, and of its corrected second printing published in 1998. The first volume dealt with linearized problems, while the second one was dedicated to fully nonlinear problems.

The current edition is new in many significant ways.

In the first place, the two volumes have been merged into one. This seems to me a more appropriate choice that on the one hand, provides a natural logical unity to the subject, and on the other hand, furnishes a better presentation of the topics. In fact, nonlinear problems cannot be addressed properly without a careful analysis of their suitable linear counterparts, and, conversely, linearized problems can find full justification only as approximations of the complete nonlinear model.

In the second place, I have added two entirely new chapters (Chapter VIII and Chapter XI). The motivation for this addition comes from the increasing effort that mathematicians, especially over the past decade, have devoted to problems describing the interaction of a viscous liquid with rigid bodies. For this reason, I dedicated the above chapters to a systematic and updated analysis of a fundamental question of liquid–solid interaction, namely, the steady flow of a viscous liquid around a body that is allowed to translate and to rotate. In the years 2003 through 2010, over fifty relevant mathematical papers, directly or indirectly dedicated to this subject, have been published. Therefore, I deem it very useful for the interested researcher to have a place where all significant basic results are collected and treated in an organized and detailed fashion.

Furthermore, several important new contributions to the field that were published after 1998 have led me to update numerous sections extensively, as well as to add other new ones, not to mention the corresponding substantial increase in the number of bibliographic items. Among the above contributions, I would like to point out especially those dedicated to the regularity of solutions to the nonlinear problem in arbitrary dimension, as well as those concerning the asymptotic behavior in two-dimensional exterior domains.

Another new feature of this edition is that most of the proofs given in the previous editions, not only for the main results but also for those on the periphery, have been clarified either through a simplification or else through an extended treatment. For completeness, I also have included the proofs of several basic theorems that were not provided in the previous editions.

Finally, again for the reader's sake, I have included an introductory section collecting the basic properties of Banach spaces and related results that are very often referenced in the text.

Last, but not least, I take this opportunity to convey my warmest thanks to all my colleagues from whose collaboration I have benefited enormously in writing this new edition, and in particular to Josef Bemelmans, Paul Deuring, Reinhard Farwig, Mads Kyed, Anne Robertson (who is not “just” a collaborator), Ana Silvestre, Christian Simader, and Hermann Sohr.

In conclusion, I hope that the interested scientist will enjoy this book and derive great benefit from reading it just as I did while writing it.

Pittsburgh, Beechwood Blvd
April 2011

G.P. Galdi

An Introduction to the Mathematical Theory of the
Navier-Stokes Equations

Steady-State Problems

Galdi, G.P.

2011, XIV, 1018 p. 4 illus.,

ISBN: 978-0-387-09620-9