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Soggetti	Mathematical physics Optics Electrodynamics Engineering mathematics Functional analysis Plasma (Ionized gases) Mathematical Applications in the Physical Sciences Classical Electrodynamics Engineering Mathematics Functional Analysis Theoretical, Mathematical and Computational Physics Plasma Physics
Lingua di pubblicazione	Inglese
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Nota di contenuto	Foreword -- Physical framework and models -- Electromagnetic fields and Maxwell’s equations -- Stationary equations -- Coupling with other models -- Approximate models -- Elements of mathematical classifications -- Boundary conditions and radiation conditions -- Energy matters -- Bibliographical notes -- Basic applied functional analysis -- Function spaces for scalar fields -- Vector fields: standard function spaces -- Practical function spaces in the (t, x) variable -- Complements of applied functional analysis -- Vector fields: tangential trace revisited -- Scalar and vector potentials: the analyst’s and topologist’s points of view -- Extraction of scalar potentials and

consequences -- Extraction of vector potentials -- Extraction of vector potentials – Vanishing normal trace -- Extraction of vector potentials – Complements -- Helmholtz decompositions -- Abstract mathematical framework -- Basic Results -- Static problems -- Time-dependent problems -- Time-dependent problems: improved regularity results -- Time-harmonic problems -- Summing up -- Analyses of exact problems: first-order models -- Energy matters: uniqueness of the fields -- Well-posedness -- Analyses of approximate models -- Electrostatic problem -- Magnetostatic problem -- Further comments around static problems -- Other approximate models -- Analyses of exact problems: second-order models -- First-order to second-order equations -- Well-posedness of the second-order Maxwell equations -- Second-order to first-order equations -- Other variational formulations -- Compact imbeddings -- Improved regularity for augmented and mixed augmented formulations -- Analyses of time-harmonic problems -- Compact imbeddings: complements -- Free vibrations in a domain encased in a cavity -- Sustained vibrations -- Interface problem between a dielectric and a Lorentz material -- Comments -- Dimensionally reduced models: derivation and analyses -- Two-and-a-half dimensional (2 1/2 2D) models -- Two-dimensional (2D) models -- Some results of functional analysis -- Existence and uniqueness results (2D problems) -- Analyses of coupled models -- The Vlasov–Maxwell and Vlasov–Poisson systems -- Magnetohydrodynamics -- References -- Index of function spaces -- Basic Spaces -- Electromagnetic spaces -- Dimension reduction and weighted spaces -- Spaces measuring time regularity -- List of Figures -- Index.

Sommario/riassunto

This book presents an in-depth treatment of various mathematical aspects of electromagnetism and Maxwell's equations: from modeling issues to well-posedness results and the coupled models of plasma physics (Vlasov-Maxwell and Vlasov-Poisson systems) and magnetohydrodynamics (MHD). These equations and boundary conditions are discussed, including a brief review of absorbing boundary conditions. The focus then moves to wellposedness results. The relevant function spaces are introduced, with an emphasis on boundary and topological conditions. General variational frameworks are defined for static and quasi-static problems, time-harmonic problems (including fixed frequency or Helmholtz-like problems and unknown frequency or eigenvalue problems), and time-dependent problems, with or without constraints. They are then applied to prove the well-posedness of Maxwell’s equations and their simplified models, in the various settings described above. The book is completed with a discussion of dimensionally reduced models in prismatic and axisymmetric geometries, and a survey of existence and uniqueness results for the Vlasov-Poisson, Vlasov-Maxwell and MHD equations. The book addresses mainly researchers in applied mathematics who work on Maxwell’s equations. However, it can be used for master or doctorate-level courses on mathematical electromagnetism as it requires only a bachelor-level knowledge of analysis.