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Titolo	Introduction to modern methods of quantum many-body theory and their applications [[electronic resource] /] / editors, Adelchi Fabrocini, Stefano Fantoni, Eckhard Krotscheck
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Collana	Series on advances in quantum many-body theory ; ; v. 7
Altri autori (Persone)	FabrociniA FantoniS (Stefano) KrotscheckEckhard
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Note generali	Lecture notes of the second European Summer School on Microscopic Quantum Many-Body Theories and their Applications, held in Miramare, Trieste, Italy, on September 3-14, 2001.
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Nota di contenuto	CONTENTS ; PREFACE ; Chapter 1 DENSITY FUNCTIONAL THEORY ; 1. Introduction ; 1.1. Units and notation ; 1.2. Hartree-Fock theory ; 1.3. Homogeneous electron gas ; 1.3.1. Free electrons ; 1.3.2. Exchange energy ; 2. What is density functional theory? ; 2.1. Hohenberg-Kohn theorem 2.2. A simple example: the Thomas-Fermi theory 2.2.1. Variational equation of Thomas-Fermi theory ; 2.2.2. Thomas-Fermi atom ; 2.2.3. An example ; 3. Kohn-Sham theory ; 3.1. Local density approximation ; 3.2. Spin and the local spin density approximation 3.3. The generalized gradient approximation 4. Numerical methods for the Kohn-Sham equation ; 4.0.1. Exact exchange ; 4.0.2. 0(N) methods ; 5. Some applications and limitations of DFT ; 5.1. Two examples of condensed matter ; 5.2. Vibrations ; 5.3. NMR chemical shifts

6. Limitations of DFT 7. Time-dependent density functional theory: the equations ; 7.1. Optical properties ; 7.1.1. f-sum rule ; 7.2. Methods to solve the TDDFT equations ; 7.2.1. Linear response formula ; 7.3. Dynamic polarizability ; 7.4. Dielectric function 8. TDDFT: numerical aspects 8.1. Configuration matrix method ; 8.2. Linear response method ; 8.3. Sternheimer method ; 8.4. Real time method ; 9. Applications of TDDFT ; 9.1. Simple metal clusters ; 9.2. Carbon structures ; 9.3. Diamond ; 9.4. Other applications 9.5. Limitations

Sommario/riassunto

This invaluable book contains pedagogical articles on the dominant nonstochastic methods of microscopic many-body theories - the methods of density functional theory, coupled cluster theory, and correlated basis functions - in their widest sense. Other articles introduce students to applications of these methods in front-line research, such as Bose-Einstein condensates, the nuclear many-body problem, and the dynamics of quantum liquids. These keynote articles are supplemented by experimental reviews on intimately connected topics that are of current relevance. The book addresses the striking