

1. Record Nr.	UNINA9910464512403321
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Titolo	One hundred physics visualizations using MATLAB / / Dan Green
Pubbl/distr/stampa	Singapore : , : World Scientific Publishing, , 2014 ©2014
ISBN	981-4518-45-X
Descrizione fisica	1 online resource (312 p.)
Disciplina	519.4028553042
Soggetti	Physics - Data processing Numerical analysis - Computer programs Electronic books.
Lingua di pubblicazione	Inglese
Formato	Materiale a stampa
Livello bibliografico	Monografia
Note generali	Description based upon print version of record.
Nota di bibliografia	Includes bibliographical references and index.
Nota di contenuto	Preface; Contents; 1. Symbolic Mathematics and Math Tools; 1.1 MATLAB Functions; 1.2 Symbolic Differentiation; 1.3 Symbolic Integration; 1.4 Taylor Expansion; 1.5 Series Summation; 1.6 Polynomial Factorization; 1.7 Equation Solving; 1.8 Inverse Functions; 1.9 Matrix Inversion; 1.10 Matrix Eigenvalues; 1.11 Ordinary Differential Equations; 1.12 Fourier Series; 1.13 Data Fitting; 1.14 MATLAB Utilities; 2. Classical Mechanics; 2.1 Simple Harmonic Oscillator; 2.2 Coupled Pendulums; 2.3 Triatomic Molecule; 2.4 Scattering Angle and Force Laws; 2.5 Classical Hard Sphere Scattering 2.6 Ballistics and Air Resistance 2.7 Rocket Motion - Symbolic and Numerical; 2.8 Taking the Free Subway; 2.9 Large Angle Oscillations - Pendulum; 2.10 Double Pendulum; 2.11 Coriolis Force; 2.12 Kepler Orbits-Numerical; 2.13 Analytic Kepler Orbits - Energy Considerations; 2.14 Stable Orbits and Perihelion Advance; 3. Electromagnetism; 3.1 Electric Potential for Point Charges; 3.2 Image Charge for a Grounded Sphere; 3.3 Magnetic Current Loop; 3.4 Helmholtz Coil; 3.5 Magnetic Shielding; 3.6 Potentials and Complex Variables; 3.7 Numerical Solution-Laplace Equation 3.8 Numerical Solution-Poisson Equation 3.9 Light Pressure and Solar Sailing; 3.10 Motion in Electric and Magnetic Fields; 3.11 The Cyclotron; 3.12 Dipole Radiation; 4. Waves and Optics; 4.1 Adding Waves; 4.2

Damped and Driven Oscillations; 4.3 A Plucked String; 4.4 A Circular Drum; 4.5 Diffraction by Slits and Apertures; 4.6 Edge Diffraction; 4.7 Doppler Shift and Cerenkov Radiation; 4.8 Reflection and Transmission at an Interface; 4.9 A Spherical Mirror; 4.10 A Spherical Lens; 4.11 A Magnetic Quadrupole Lens System; 5. Gases and Fluid Flow; 5.1 The Atmosphere

5.2 An Ideal Gas Model in Two Dimensions 5.3 Maxwell-Boltzmann Distributions; 5.4 Fermi-Dirac and Bose-Einstein Distributions; 5.5 Chemical Potential, Bosons; 5.6 Chemical Potential, Fermions; 5.7 Critical Temperature for He; 5.8 Exact Fermion Chemical Potential; 5.9 Complex Variables and Flow; 5.10 Complex Variables and Airfoils; 5.11 Complex Variables and Sources of Flow; 5.12 Viscosity Model; 5.13 Transport and Viscosity; 5.14 Fluid Flow in a Pipe; 5.15 Heat and Diffusion; 6. Quantum Mechanics; 6.1 Preliminaries-Planck Distribution; 6.2 Bound States - Oscillating or Damped 6.3 Hydrogen Atom 6.4 Periodic Table - Ionization Potential and Atomic Radius; 6.5 Simple Harmonic Oscillator; 6.6 Other Force Laws; 6.7 Deep Square Well; 6.8 Shallow Square Well; 6.9 Wave Packets; 6.10 Numerical Solution for Bound States; 6.11 Scattering off a Potential Step; 6.12 Scattering Off a Potential Well or Barrier; 6.13 Wave Packet Scattering on a Well or Barrier; 6.14 Born Approximation - Scattering and Force Laws; 6.15 Spherical Harmonics - 3D; 6.16 Free Particle in 3D; 6.17 Radioactive Decay-Fitting; 7. Special and General Relativity; 7.1 Time Dilation; 7.2 Relativistic Travel

7.3 The Relativistic Rocket

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### Sommario/riassunto

This book provides visualizations of many topics in general physics. The aim is to have an interactive MATLAB script wherein the user can vary parameters in a specific problem and then immediately see the outcome by way of dynamic "movies" of the response of the system in question. MATLAB tools are used throughout and the software scripts accompany the text in Symbolic Mathematics, Classical Mechanics, Electromagnetism, Waves and Optics, Gases and Fluid Flow, Quantum Mechanics, Special and General Relativity, and Astrophysics and Cosmology. The emphasis is on building up an intuition by runnin

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