

Mathematica for theoretical physics

suggested topics

- ▶ Mechanics:
 - Solution of equations of motion (e.g. Gravitational field, field of charges)
 - Analytical (if possible), numerical, graphical presentation
 - Verification of conservatin laws (Energy, momentum, angular momentum,...)
 - Coupled harmonic oscillators
 - Corrdinate transformations
 - Special relativity: transformations, equations of motion
- ▶ Electrostatics: (a lot of vector algebra and analysis)
 - Fields from charges, Potential, Electric field
 - Fields from charges- (and current) distributions
 - Boundary value problems
 - "Nabla" operator (gradient, divergence, curl, combinations)
- ▶ Statistics:
 - Statistic analysis of inaccurate data
 - Least-square fits, etc.
- ▶ Quantum mechanics
 - see <http://itp.tu-graz.ac.at/LV/arrigoni/QM/praktikum.html>
 - In addition:**
 - Operators, algebra (commutation rules etc.)
 - Simulation of a quantum computer
 - Numerical solution of Schrödinger equation by expanding in an orthogonal/nonorthogonal basis set
 - Numerical solution of Schrödinger equation by "shooting" method
 - addition of angular momenta: determining clebsch-gordan coefficients
- ▶ Mathematics:
 - cauchy integrals

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