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PHYS.5630 Computational Methods in Physics

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Scientists hunting for elusive gravitational waves across the universe may be able to supercharge their discoveries with a new tool: artificial intelligence. Gravitational waves are ripples in ...

Can artificial intelligence help scientists spot gravitational waves? When gravitational waves were first detected in 2015 by the advanced Laser Interferometer Gravitational-Wave Observatory (LIGO), they sent a ripple through the scientific community, as they confirmed ...

Scientists use artificial intelligence to detect gravitational waves This trial tells us that, yes, we can restore words to someone who ' s lost speech from paralysis. It ' s the very beginning, but it definitely tells us that this is possible, ” said Edward Chang, M.D., a ...

Neuroprosthesis Device Allows “ Speech ” for Those Who Have Lost Their Voice

WHOI joint program, is helping to design robots that can independently navigate to sites where they can take samples or measurements that will be most useful to environmental scientists.

Designing exploratory robots that collect data for marine scientists According to the TIOBE Index for July 2021, Python is the third most popular programming language. Between the most popular C, and Python, the difference is only 0.67 percent. The report further adds ...

8 Free Python Courses For Data Scientists In 2021

For example, this method can also be utilized to alter the performance ... of Technology and Nanyang Technological University, where the Skoltech scientists focused on the computational and machine ...

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The production-scale framework indicates that AI models could be as sensitive as traditional template matching algorithms, but orders of magnitude faster.

Scientists develop AI model to detect gravitational waves
When AI/ML came onto the scene in the supercomputing community, common wisdom was that it could do much to augment HPC applications but it would be not be ...

AI/ML Cuts into Traditional HPC, Plasma Physics
Meet the 11 new faculty members that have joined the Gerstner Sloan Kettering (GSK) Graduate School of Biomedical Sciences.

Eleven Scientists Join World-Renowned Faculty at Gerstner Sloan Kettering
physics and optimization. This course will give an introduction to modern techniques in the field, and how they relate to objects such as polytopes, permutations and hyperplane arrangements. An ...

Applied and Computational Mathematics
Researchers from Skoltech have found a way to help computer vision algorithms process satellite images of the Earth more accurately, even with minimal data for training. This will make various remote ...

Learning aids: Skoltech method helps train computer vision algorithms on limited data
Even though other research groups have applied computational methods to reposition medicines ... from the Department of Mathematics, Physics and Computing Sciences of the CEU UCH, and Jean Louis ...

New computational topology strategy to identify existing medicines for treating COVID-19
First published in 2007, this second edition describes the

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computational methods used in theoretical physics. New sections were added to cover finite element methods and lattice Boltzmann simulation, ...

This book is intended to help advanced undergraduate, graduate, and postdoctoral students in their daily work by offering them a compendium of numerical methods. The choice of methods pays significant attention to error estimates, stability and convergence issues, as well as optimization of program execution speeds. Numerous examples are given throughout the chapters, followed by comprehensive end-of-chapter problems with a more pronounced physics background, while less stress is given to the explanation of individual algorithms. The readers are encouraged to develop a certain amount of skepticism and scrutiny instead of blindly following readily available commercial tools. The second edition has been enriched by a chapter on inverse problems dealing with the solution of integral equations, inverse Sturm-Liouville problems, as well as retrospective and recovery problems for partial differential equations. The revised text now includes an introduction to sparse matrix methods, the solution of matrix equations, and pseudospectra of matrices; it discusses the sparse Fourier, non-uniform Fourier and discrete wavelet transformations, the basics of non-linear regression and the Kolmogorov-Smirnov test; it demonstrates the key concepts in solving stiff differential equations and the asymptotics of Sturm-Liouville eigenvalues and eigenfunctions. Among other updates, it also presents the techniques of state-space reconstruction, methods to calculate the matrix exponential, generate random permutations and compute stable derivatives.

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This book helps advanced undergraduate, graduate and postdoctoral students in their daily work by offering them a compendium of numerical methods. The choice of methods pays significant attention to error estimates, stability and convergence issues as well as to the ways to optimize program execution speeds. Many examples are given throughout the chapters, and each chapter is followed by at least a handful of more comprehensive problems which may be dealt with, for example, on a weekly basis in a one- or two-semester course. In these end-of-chapter problems the physics background is pronounced, and the main text preceding them is intended as an introduction or as a later reference. Less stress is given to the explanation of individual algorithms. It is tried to induce in the reader an own independent

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Graduate Texts in Physics
thinking and a certain amount of scepticism and scrutiny instead of blindly following readily available commercial tools.

The Compendium of Theoretical Physics contains the canonical curriculum of theoretical physics. From classical mechanics over electrodynamics, quantum mechanics and statistical physics/thermodynamics, all topics are treated axiomatic-deductively and confirmed by exercises, solutions and short summaries.

There is an increasing need for undergraduate students in physics to have a core set of computational tools. Most problems in physics benefit from numerical methods, and many of them resist analytical solution altogether. This textbook presents numerical techniques for solving familiar physical problems where a complete solution is inaccessible using traditional mathematical methods. The numerical techniques for solving the problems are clearly laid out, with a focus on the logic and applicability of the method. The same problems are revisited multiple times using different numerical techniques, so readers can easily compare the methods. The book features over 250 end-of-chapter exercises. A website hosted by the author features a complete set of programs used to generate the examples and figures, which can be used as a starting point for further investigation. A link to this can be found at www.cambridge.org/9781107034303.

The first book of its kind to cover a wide range of computational methods for electromagnetic phenomena, from atomistic to continuum scales, this integrated and balanced treatment of mathematical formulations, algorithms and the underlying physics enables us to engage in innovative and advanced interdisciplinary computational research.

Presents numerical methods and computer code in Matlab for the solution of ODEs and PDEs with detailed line-by-line discussion.

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This volume contains the essential mathematical tools and techniques used to solve problems in physics. A useful textbook for all serious undergraduate students of physics. This fifth edition has a new art programme throughout the book; additional new and improved exercises; updated references for computational techniques for using Numerical Recipes and Mathematica TM; and there is a reference compendium for important mathematical methods used in physics.

The physics of plasmas is an extremely rich and complex subject as the variety of topics addressed in this book demonstrates. This richness and complexity demands new and powerful techniques for investigating plasma physics. An outgrowth from his graduate course teaching, now with corrections, Tajima's text provides not only a lucid introduction to computational plasma physics, but also offers the reader many examples of the way numerical modeling, properly handled, can provide valuable physical understanding of the nonlinear aspects so often encountered in both laboratory and astrophysical plasmas. Included here are computational methods for modern nonlinear physics as applied to hydrodynamic turbulence, solitons, fast reconnection of magnetic fields, anomalous transports, dynamics of the sun, and more. The text contains examples of problems now solved using computational techniques including those concerning finite-size particles, spectral techniques, implicit differencing, gyrokinetic approaches, and particle simulation.

Providing coverage of the mathematics necessary for advanced study in physics and engineering, this text focuses on problem-solving skills and offers a vast array of exercises, as well as clearly illustrating and proving mathematical relations.

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