A Combined Mathematical-Physical Model of Laser-Induced Thermotherapy (LITT)

Laser-induced thermo therapy (LITT) is an alternative, gentle therapy of cancer. In this work a new computational model (3D space and time) of LITT is presented. Using an arbitrary small number (<20) of optical fibers, multiple low energy laser light sources are applied internal to an arbitrary shaped tumor in the human liver. The power and position of each source can be chosen arbitrary. Each source is a spherical point source emitting light isotropically. The model consists of two, semi-coupled partial differential equations (PDEs) describing the light distribution and the heat absorption in the target tissue. Since water is a dominant tissue component in both the healthy liver and the malignant tumor the wavelength of the laser is chosen in the NIR area (1,064 nm). This is expected to form an absorption contrast in favor of the tumor leading to high temperature and damage of the tumor cells. The new, fast computational model presented here opens for the possibility of evaluating the outcome of LITT by inspection of temperature fields, and comparing these to measured histological damage due to heating. This combination is promising when evaluating the result of LITT prior to the actual treatment.

Using High Energy Lasers to Heat and Kill the Cells in an Internal Cancerous Body Tumor

General information
State: Published
Organisations: Department of Mathematics, Applied functional analysis, Department of Electrical Engineering, Biomedical Engineering, Technical University of Denmark
Authors: Skovgaard, O. (Intern), Enevoldsen, M. S. (Intern), Hansen, L. B. (Ekstern)
Publication date: 2009

Publication information
Original language: English
Main Research Area: Technical/natural sciences
Predicting Tsunami Waves by Combining Analytical and Finite Element Methods

General information
State: Published
Organisations: Department of Mathematics, Technical University of Denmark
Authors: Aage, N. (Ekstern), Sigurbjörnsson, R. (Ekstern), Laustsen, S. (Ekstern), Skovgaard, O. (Intern)
Publication date: 2007

Publication information
ISBN (Print): 0-9766792-4-8
Original language: English
Main Research Area: Technical/natural sciences

Predicting Tsunami Waves by Combining Analytical and Finite Element Methods

General information
State: Published
Organisations: Department of Mathematics, Technical University of Denmark
Authors: Aage, N. (Ekstern), Sigurbjörnsson, R. (Ekstern), Laustsen, S. (Ekstern), Skovgaard, O. (Intern)
Publication date: 2007

Publication information
ISBN (Print): 0-9766792-4-8
Original language: English
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Using High Energy Lasers to Heat and Kill the Cells in an Internal Cancerous Body Tumor

General information
State: Published
Organisations: Applied functional analysis, Department of Mathematics, Technical University of Denmark
Authors: Skovgaard, O. (Intern), Enevoldsen, M. S. (Ekstern), Delay, L. J. (Ekstern), Hansen, L. B. (Ekstern)
Number of pages: 966
Pages: 102-106
Publication date: 2007

Host publication information
Volume: Volume 1
Place of publication: Grenoble, France
Publisher: COMSOL France -Grenoble & Paris
Editors: Petit, J., Squalli, O.
ISBN (Print): 978-0-9766792-5-7
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 208661
Publication: Research - peer-review › Article in proceedings – Annual report year: 2007

Predicting Tsunami Waves by Combining Analytical and Finite Element Methods

General information
State: Published
Organisations: Applied functional analysis, Department of Mathematics, Technical University of Denmark
Authors: Aage, N. (Ekstern), Sigurbjörnsson, R. (Ekstern), Laustsen, S. (Ekstern), Skovgaard, O. (Intern)
Number of pages: 150
Pages: 59-64
Publication date: 2006

Host publication information
Title of host publication: Nordic Comsol Conference 2006 : Copenhagen
Place of publication: Copenhagen
Publisher: COMSOL A/S
Editor: Gregersen, L.
ISBN (Print): 87-989426-1-1
Shoulder Muscle Forces during Work: EMG-based Biomechanical Models

General information
State: Published
Organisations: Department of Mathematics, Applied functional analysis
Authors: Laursen, B. (Intern), Skovgaard, O. (Intern)
Publication date: Oct 1996

Publication information
Place of publication: Kgs. Lyngby, Denmark
Publisher: Technical University of Denmark (DTU)
Original language: English
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 276260
Publication: Research › Ph.D. thesis – Annual report year: 1996

Effect of gain nonlinearity in semiconductor lasers
Semiconductor lasers are modeled by single-mode rate equations with Langevin noise terms and the influence of nonlinear gain is investigated. For cw operation the probability distribution for the carrier number and the photon number in the laser cavity is obtained. The corresponding (2+1)-dimensional Fokker-Planck equation is derived and integrated on an Amdahl VP1100 vector processor. Above threshold the resulting probability density agrees with the rate-equation predictions. The case of high-speed modulation is also considered. The nonlinear gain is found to stabilize the laser.

General information
State: Published
Organisations: Department of Informatics and Mathematical Modeling, Applied functional analysis, Department of Mathematics, Technical University of Denmark
Authors: Jensen, N. H. (Ekstern), Christiansen, P. L. (Intern), Skovgaard, O. (Intern)
Pages: 8219-8225
Publication date: 1988
Main Research Area: Technical/natural sciences

Publication information
Journal: Physical Review B Condensed Matter
Volume: 38
Issue number: 12
ISSN (Print): 0163-1829
Ratings:
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 3.16
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 1.933 SNIP 0.94 CiteScore 2.8
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 2.667 SNIP 1.262 CiteScore 3.3
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 2.785 SNIP 1.339 CiteScore 3.55
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 3.206 SNIP 1.394 CiteScore 3.57
Temperature effects on the Davydov soliton

As a possible mechanism for energy storage and transport in proteins, Davydov has proposed soliton formation and propagation. In this paper we investigate the stability of Davydov solitons at biological temperatures. From Davydov’s original theory evolution equations are derived quantum mechanically without approximations, and their numerical solutions at different temperatures are presented. Our conclusion is that the Davydov soliton is stable at 310 K.

General information
State: Published
Organisations: Department of Informatics and Mathematical Modeling, Applied functional analysis, Department of Mathematics, Technical University of Denmark
Authors: Cruzeiro, L. (Ekstern), Halding, J. (Ekstern), Christiansen, P. L. (Intern), Skovgaard, O. (Intern), Scott, A. C. (Intern)

Bibliographical note
Copyright (1988) by the American Physical Society.
Source: orbit
Source-ID: 250750
Publication: Research - peer-review › Journal article – Annual report year: 1988
Solitary waves on nonlinear elastic rods. II.
In continuation of an earlier study of propagation of solitary waves on nonlinear elastic rods, numerical investigations of blowup, reflection, and fission at continuous and discontinuous variation of the cross section for the rod and reflection at the end of the rod are presented. The results are compared with predictions of conservation theorems for energy and momentum.
An improved computational two-cavity model of the soliton laser proposed and designed by Mollenauer and Stolen [Opt. Lett. 9, 13 (1984)] is obtained through refinements of (i) the laser cavity model, (ii) the pulse propagation in the fiber cavity, and (iii) the coupling between the two cavities. As a result of the coupling to the fiber cavity, stable output pulses of temporal width 7.5 psec from the laser cavity are narrowed by a factor of approximately 10.

General information
State: Published
Organisations: Department of Informatics and Mathematical Modeling, Applied functional analysis, Department of Mathematics, Technical University of Denmark
Authors: Berg, P. (Ekstern), If, F. (Ekstern), Christiansen, P. L. (Intern), Skovgaard, O. (Intern)
Pages: 4167-4174
Publication date: 1987
Main Research Area: Technical/natural sciences
Switching between dynamic states in intermediate-length Josephson junctions
The appearance of zero-field steps (ZFS's) in the current-voltage characteristics of intermediate-length overlap-geometry Josephson tunnel junctions described by a perturbed sine-Gordon equation (PSGE) is associated with the growth of parametrically excited instabilities of the McCumber background curve (MCB). A linear stability analysis of a McCumber solution of the PSGE in the asymptotic linear region of the MCB and in the absence of magnetic field yields a Hill's equation which predicts how the number, locations, and widths of the instability regions depend on the junction parameters. A numerical integration of the PSGE in terms of truncated series of time-dependent Fourier spatial modes verifies that the parametrically excited instabilities of the MCB evolve into the fluxon oscillations characteristic of the ZFS's. An approximate analysis of the Fourier mode equations in the presence of a small magnetic field yields a field-dependent Hill's equation which predicts that the major effect of such a field is to reduce the widths of the instability regions. Experimental measurements on Nb-NbxOy-Pb junctions of intermediate length, performed at different operating temperatures in order to vary the junction parameters and for various magnetic field values, verify the physical existence of switching from the MCB to the ZFS's. Good qualitative, and in many cases quantitative, agreement between analytic, numerical, and experimental results is obtained.
Simulation studies of radiation linewidth in circular Josephson-junction fluxon oscillators

Detailed simulation studies of the dynamics of fluxons in long circular Josephson tunnel junctions under the influence of external microwave radiation and internal thermal noise are presented. The simulation algorithm uses a pseudospectral method well adapted to vector processors (CRAY-1-S), which gives a speed-up factor in computing time of typically 22 in comparison to conventional high-speed computers, and also provides results with a relative accuracy of less than 10-8 thereby making possible the study of the very narrow radiation linewidth of such oscillators. Comparison of calculated linewidths with experimental results shows good agreement.
Magnetic field dependence of microwave radiation in intermediate-length Josephson junctions

Experimental measurements of current-voltage structure and emitted X-band radiation in applied magnetic field from overlap-geometry Josephson tunnel junctions of normalized length about 2 are compared with numerical simulations obtained with the use of a perturbed sine-Gordon model. The simulations furnish the current and field dependence of the oscillation configuration, from which can be calculated average voltages, frequencies, and power spectra. Simulation and experimental results are in good agreement with regard to the lobe structure of the height of the first zero-field step and/or second Fiske step in magnetic field and the field dependence of the radiation frequency within the various lobes, including details such as hysteresis between lobes. The simulations predict an alternation of the dominant frequency component with increasing field that accounts well for the experimental observations. The usefulness and limitations of cavity-mode analyses, both singlemode and multimode, are evidenced by comparison with the simulation results.
Intermittent Switching between Soliton Dynamic States in a Perturbed Sine-Gordon Model

Chaotic intermittency between soliton dynamic states has been found in a perturbed sine-Gordon system in the absence of an external ac driving term. The system is a model of a long Josephson oscillator with constant loss and bias current in an external magnetic field. The results predict the existence of a current step between the first two Fiske steps in the current-voltage characteristic. A simple probability model demonstrates an asymmetry in the statistical nature of the switching in the two directions.
Subharmonic generation in Josephson junction fluxon oscillators biased on Fiske steps

Numerical integration of the perturbed sine-Gordon equation describing a long overlap-geometry Josephson junction in a magnetic field indicates a branched structure of the first Fiske step. The major portion of the step corresponds to a simply periodic fluxon oscillation whereas the branches are characterized by subharmonic generation. Applied Physics Letters is copyrighted by The American Institute of Physics.

General information
State: Published
Organisations: Department of Informatics and Mathematical Modeling, Applied functional analysis, Department of Mathematics, Technical University of Denmark
Authors: Sørensen, M. P. (Intern), Christiansen, P. L. (Intern), Parmentier, R. D. (Ekstern), Skovgaard, O. (Intern)
Pages: 739-741
Publication date: 1983
Main Research Area: Technical/natural sciences

Publication information
Volume: 42
Issue number: 8
ISSN (Print): 0003-6951
Ratings:
BFI (2018): BFI-level 2
BFI (2017): BFI-level 2
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 2.67 SJR 1.132 SNIP 0.996
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 1.085 SNIP 0.983 CiteScore 2.47
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 1.799 SNIP 1.462 CiteScore 3.25
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 2.149 SNIP 1.652 CiteScore 3.77
A non-destructive method, scanning acoustic microscopy (SAM), is being developed for the purpose of tissue analysis and characterisation of materials. The aim is resolution improvements and investigation of the passive elastic properties from
specimens of the abdominal aorta to study early stages of arteriosclerosis

Department of Mathematics

Aarhus University
Period: 01/01/1996 → …
Number of participants: 2
Project participant:
Poulsen, Jens Kristian (Ekstern)
Project Manager, organisational:
Skovgaard, Ove (Intern)

Models for Vibration Levels Caused by Railway Traffic
The project is concerned with developing models for estimating vibration levels caused by railway traffic. Estimates of vibration levels from passenger trains are found by two fundamentally different methods: 1) A neural network model. 2) A statistical model. The work is carried out in close cooperation with the industry.

Department of Mathematics

Department of Geology and Geotechnical Engineering
DSB Consult
Rambøll Danmark A/S
Geotechnical Institute
Period: 01/01/1996 → 01/04/1997
Number of participants: 2
Project participant:
Hansen, Bent (Intern)
Project Manager, organisational:
Skovgaard, Ove (Intern)

Shoulder Muscle Forces during Work
Work with human hands and arms imply a live load of the muscles in the shoulder. In the project several methods to determine the live load on shoulder muscles have been developed for different situations with the aim of minimizing the static load when designing a work place. The work is carried out in cooperation with Bjarne Laursen and Gisela Sjøegaard, both at the National Institute of Occupational Healths, Denmark.

Department of Mathematics
Period: 01/01/1996 → 01/11/1996
Number of participants: 1
Project Manager, organisational:
Skovgaard, Ove (Intern)

Biomekanisk Skuldermodel

Department of Mathematics
Period: 01/12/1992 → 07/10/1996
Number of participants: 2
Phd Student:
Laursen, Bjarne (Intern)
Main Supervisor:
Skovgaard, Ove (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Forskerakademiets Samfinansier
Project: PhD

European Consortium for Mathematics in Industry (ECMI)
The goal of ECMI is to promote the interaction between universities and research groups in industry. The aims of ECMI are to promote the use of mathematical models in industry, to educate industrial mathematicians to meet the growing demand for such experts and finally to operate on a European scale. Activities comprises: Attracting EU funding for post docs and research in industrial mathematics, student exchange through ERASMUS, organizing ECMI modelling weeks, biannual conferences, European Study Groups for Industry (ESGI), and others.

Department of Informatics and Mathematical Modeling

Department of Mathematics
Period: 01/01/1991 → …
Number of participants: 6
Project participant:
Poulisen, Niels Kjølstad (Intern)
Brøns, Morten (Intern)
Hjorth, Poul G. (Intern)
Skovgaard, Ove (Intern)
Christensen, Ole (Intern)
Project Manager, organisational:
Sørensen, Mads Peter (Intern)
Project