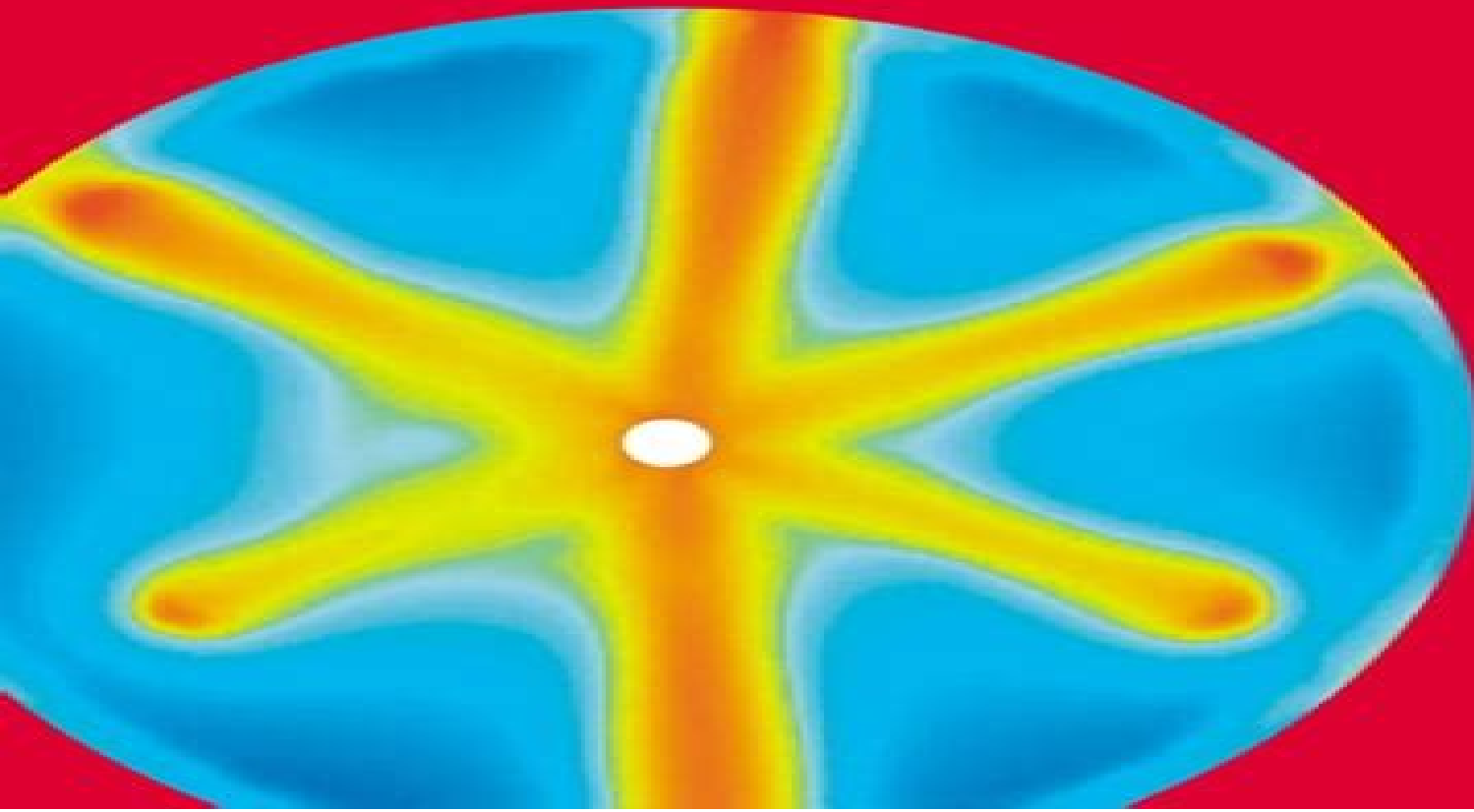


# Nonlinear Spatio-Temporal Dynamics and Chaos in Semiconductors

Eckehard Schöll

Cambridge Nonlinear Science Series 10



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**Alexander S Mikhailov, Gerhard Ertl**



## **Nonlinear Spatio Temporal Dynamics And Chaos In Semiconductors Cambridge Nonlinear Science Series:**

*Nonlinear Spatio-Temporal Dynamics and Chaos in Semiconductors* Eckehard Schöll, 2001-02-22 This book brings together concepts from semiconductor physics nonlinear dynamics and chaos to examine semiconductor transport phenomena

**Control of Complex Nonlinear Systems with Delay** Philipp Hövel, 2010-09-27 This research addresses delay effects in nonlinear systems which are ubiquitous in various fields of physics chemistry biology engineering and even in social and economic systems They may arise as a result of processing times or due to the finite propagation speed of information between the constituents of a complex system Time delay has two complementary counterintuitive and almost contradictory facets On the one hand delay is able to induce instabilities bifurcations of periodic and more complicated orbits multi stability and chaotic motion On the other hand it can suppress instabilities stabilize unstable stationary or periodic states and may control complex chaotic dynamics This thesis deals with both aspects and presents novel fundamental results on the controllability of nonlinear dynamics by time delayed feedback as well as applications to lasers hybrid mechanical systems and coupled neural systems

**High Performance Computing in Science and Engineering '02** Egon Krause, Willi Jäger, 2012-12-06 This book presents the state of the art in modeling and simulation on supercomputers Leading German research groups present their results achieved on high end systems of the High Performance Computing Center Stuttgart HLRS for the year 2002 Reports cover all fields of supercomputing simulation ranging from computational fluid dynamics to computer science Special emphasis is given to industrially relevant applications Moreover by presenting results for both vector systems and micro processor based systems the book allows to compare performance levels and usability of a variety of supercomputer architectures It therefore becomes an indispensable guidebook to assess the impact of the Japanese Earth Simulator project on supercomputing in the years to come

Dissipative Solitons in Reaction Diffusion Systems Andreas Liehr, 2013-03-27 Why writing a book about a specialized task of the large topic of complex systems And who will read it The answer is simple The fascination for a didactically valuable point of view the elegance of a closed concept and the lack of a comprehensive disquisition The fascinating part is that field equations can have localized solutions exhibiting the typical characteristics of particles Regarding the field equations this book focuses on the field phenomenon of localized solutions can be described in the context of a particle formalism which leads to a set of ordinary differential equations covering the time evolution of the position and the velocity of each particle Moreover starting from these particle dynamics and making the transition to many body systems one considers typical phenomena of many body systems as shock waves and phase transitions which themselves can be described as field phenomena Such transitions between different level of modelling are well known from conservative systems where localized solutions of quantum field theory lead to the mechanisms of elementary particle interaction and from this to field equations describing the properties of matter However in dissipative systems such transitions have not been considered yet which is adjusted by the presented book The elegance of

a closed concept starts with the observation of self organized current filaments in a semiconductor gas discharge system. These filaments move on random paths and exhibit certain particle features like scattering or the formation of bound states. Neither the reasons for the propagation of the filaments nor the laws of the interaction between the filaments can be registered by direct observations. Therefore a model is established which is phenomenological in the first instance due to the complexity of the experimental system. This model allows to understand the existence of localized structures, their mechanisms of movement and their interaction at least on a qualitative level. But this model is also the starting point for developing a data analysis method that enables the detection of movement and interaction mechanisms of the investigated localized solutions. The topic is rounded off by applying the data analysis to real experimental data and comparing the experimental observations to the predictions of the model. A comprehensive publication covering the interesting topic of localized solutions in reaction diffusion systems in its width and its relation to the well known phenomena of spirals and patterns does not yet exist and this is the third reason for writing this book. Although the book focuses on a specific experimental system, the model equations are as simple as possible so that the discussed methods should be adaptable to a large class of systems showing particle like structures. Therefore this book should attract not only the experienced scientist who is interested in self organization phenomena but also the student who would like to understand the investigation of a complex system on the basis of a continuous description. Dynamical Systems René Lozi, Safwan El

Assad, Mohammed-Salah Abdelouahab, 2025-06-23 This book offers a captivating exploration of the intersection between mathematics, chaos theory and dynamical systems through the personal journeys of twelve renowned mathematicians and physicists from China, Europe, Russia and the USA. The first section of the book provides an intimate look into the formative experiences and early steps of these scientists. In these life stories, the names of other famous mathematicians arise crisscrossing all the stories in unexpected ways. The second part of the book explores the practical applications of chaotic attractors in various fields. These include chaos based encryption in cryptography, sensor and actuator placement in Chua circuits for control systems and chaotic dynamics in remote sensing for crop modeling. It also highlights the role of chaos theory in the development of memristors following Leon Chua's 1971 discovery leading to advances in nonlinear dynamics, hyperchaos and memristor based systems. The chapters further examine how chaos theory addresses modern challenges such as modeling COVID 19 spread using SEIR models and optimizing mobile network design, demonstrating the wide reaching impact of chaotic systems in real world applications. This book will be of great value to students and researchers in mathematics, physics, engineering and related disciplines seeking to deepen their understanding of chaotic dynamical systems and their applications. This book includes a revised introduction and a new chapter. The remaining chapters were originally published in Journal of Difference Equations and Applications. Delay Controlled Partial Synchronization in Complex Networks Jakub Sawicki, 2019-11-30 The focus of this thesis are synchronization phenomena in networks and their intrinsic

control through time delay which is ubiquitous in real world systems ranging from physics and acoustics to neuroscience and engineering We encounter synchronization everywhere and it can be either a helpful or a detrimental mechanism In the first part after a survey of complex nonlinear systems and networks we show that a seemingly simple system of two organ pipes gives birth to complex bifurcation and synchronization scenarios Going from a 2 oscillator system to a ring of oscillators we encounter the intriguing phenomenon of chimera states which are partial synchrony patterns with coexisting domains of synchronized and desynchronized dynamics For more than a decade scientist have tried to solve the puzzle of this spontaneous symmetry breaking emerging in networks of identical elements We provide an analysis of initial conditions and extend our model by the addition of time delay and fractal connectivities In the second part we investigate partial synchronization patterns in a neuronal network and explain dynamical asymmetry arising from the hemispheric structure of the human brain A particular focus is on the novel scenario of partial relay synchronization in multiplex networks Such networks allow for synchronization of the coherent domains of chimera states via a remote layer whereas the incoherent domains remain desynchronized The theoretical framework is demonstrated with different generic models

*Engineering Of Chemical Complexity Ii* Alexander S Mikhailov, Gerhard Ertl, 2014-10-14 This second review volume is a follow up to the book *Engineering of Chemical Complexity* that appeared in 2013 Co edited by the Nobel laureate Gerhard Ertl this book provides a broad perspective over the current research aimed at understanding the design and control of complex chemical systems of various origins on the scales ranging from single molecules and nano phenomena to macroscopic chemical reactors Self organization behavior and emergence of coherent collective dynamics in reaction diffusion systems in active soft matter and biochemical networks are discussed Special attention is paid to applications in cell biology to molecular motors and microfluidics effects The reviews prepared by leading international experts from the EU USA Russia and Japan together yield a fascinating picture of a rapidly developing research discipline that brings chemical engineering to new frontiers

**Dynamics of Quantum Dot Lasers** Christian Otto, 2014-01-21 This thesis deals with the dynamics of state of the art nanophotonic semiconductor structures providing essential information on fundamental aspects of nonlinear dynamical systems on the one hand and technological applications in modern telecommunication on the other Three different complex laser structures are considered in detail i a quantum dot based semiconductor laser under optical injection from a master laser ii a quantum dot laser with optical feedback from an external resonator and iii a passively mode locked quantum well semiconductor laser with saturable absorber under optical feedback from an external resonator Using a broad spectrum of methods both numerical and analytical this work achieves new fundamental insights into the interplay of microscopically based nonlinear laser dynamics and optical perturbations by delayed feedback and injection

*Encyclopedia of Nonlinear Science* Alwyn Scott, 2006-05-17 In 438 alphabetically arranged essays this work provides a useful overview of the core mathematical background for nonlinear science as well as its applications to key problems in ecology and biological systems

chemical reaction diffusion problems geophysics economics electrical and mechanical oscillations in engineering systems lasers and nonlinear optics fluid mechanics and turbulence and condensed matter physics among others     Synchronization  
Alexander Balanov, Natalia Janson, Dmitry Postnov, Olga Sosnovtseva, 2008-11-23 This fascinating work is devoted to the fundamental phenomenon in physics synchronization that occurs in coupled non linear dissipative oscillators Examples of such systems range from mechanical clocks to population dynamics from the human heart to neural networks The main purpose of this book is to demonstrate that the complexity of synchronous patterns of real oscillating systems can be described in the framework of the general approach and the authors study this phenomenon as applied to oscillations of different types such as those with periodic chaotic noisy and noise induced nature

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In an electronic digital era where connections and knowledge reign supreme, the enchanting power of language has be more apparent than ever. Its capability to stir emotions, provoke thought, and instigate transformation is really remarkable. This extraordinary book, aptly titled "**Nonlinear Spatio Temporal Dynamics And Chaos In Semiconductors Cambridge Nonlinear Science Series**," compiled by a very acclaimed author, immerses readers in a captivating exploration of the significance of language and its profound impact on our existence. Throughout this critique, we will delve into the book is central themes, evaluate its unique writing style, and assess its overall influence on its readership.

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