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Modelling And
Simulation Of
Diffusive
Processes
Simulation Of
Methods And
Diffusive
Applications
Processes
Foundations
Methods And
Applications
Simulation

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Foundations Methods And Simulation Of Diffusive Applications

*The general aim of
this book is to present
selected chapters of
the following types:
chapters with more
focus on modeling
with some necessary
simulation details and*

Applications

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*chapters with less
focus on modeling but
with more simulation
details. This book
contains eleven
chapters divided into
two sections:*

*Modeling in
Continuum Mechanics
and Modeling in
Electronics and
Engineering. We hope
our book entitled*

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*"Modeling and
Simulation in*

*Engineering - Selected
Problems" will serve
as a useful reference
to students, scientists,
and engineers.*

*Modelling and
Simulation of
Diffusive
Processes Methods
and*

Applications Springer
Page 4/126

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Modelling And
Science & Business
Simulation Of
Media
Diffusive
Continuum Approach
for Modeling and
Methods And
Simulation of Fluid
Diffusion Through a
Porous Finite Elastic
Solid
Foundations
Methods and
Applications
Modeling and
Simulation of Arsenic
Activation and

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Download

*Modelling And
Simulation Of
Diffusive
Processes
Numerical Simulation
for Diffusive Models
of Resource and
Sexual Competition*

This practical
introduction to
stochastic reaction-
diffusion modelling
is based on courses
taught at the
University of

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Applications
Simulation
Foundations
Methods And
Applications

Oxford. The authors discuss the essence of mathematical methods which appear (under different names) in a number of interdisciplinary scientific fields bridging mathematics and computations with biology and

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chemistry. The book can be used both for self-study and as a supporting text for advanced undergraduate or beginning graduate-level courses in applied mathematics. New mathematical approaches are explained using simple examples of

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biological models,
which range in size
from simulations of
small biomolecules
to groups of
animals. The book
starts with
stochastic modelling
of chemical
reactions,
introducing
stochastic
simulation
algorithms and

Where To
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Modelling And
mathematical
Simulation Of
methods for
analysis of
stochastic models.
Different stochastic
spatio-temporal
models are then
studied, including
models of diffusion
and stochastic
reaction-diffusion
modelling. The
methods covered
include molecular

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dynamics, Brownian dynamics, velocity jump processes and compartment-based (lattice-based) models.

Evaporation of solvent from a polymer solution has technological importance in technologies related to painting, coating, inkjet printing,

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Modelling And
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manufacturing
polymer films and
production of
electronic devices.

Methods And
Applications
Simulation
Foundations
Methods And
Applications
Apart from the vast
technological
importance, it is
one of the
fundamental
problems of soft
condensed matter
physics. A
mathematical model
in the framework of

Where To
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Modelling And
Simulation Of
nonequilibrium
thermodynamics
was developed to
describe the
evolution of
concentration and
temperature during
evaporation of a
solvent in a
polymer solution.
The governing
equations derived
from the
fundamental

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Modelling And

Simulation Of
equation of classical
thermodynamics

using the local

equilibrium

hypothesis,

Prigogine's theorem

and Onsager's

reciprocity relations

display more

complex connection

between heat and

non-convective

mass fluxes than

what has been

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presented in the
previous research
works. The model
developed herein
describes evolution
of concentration
and temperature in
an evaporating
polymer solution in
a
thermodynamically
consistent way and
is able to capture
the effect of

Where To Download

thermal diffusion in
polymer solutions.

The derived
governing equations
which were
formulated for a
general 3D problem
were solved
numerically for a
1D solution casting
problem using an
explicit finite
difference scheme.

During the

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evaporation of solvent, the effect of thermal diffusion in polymer solutions manifests itself as an increase in local concentration of the solvent on the warm side of a temperature gradient. The results of the model also can qualitatively

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Modelling And
capture some
Simulation Of
experimental
Diffusion
observations
regarding the Soret
effect in polymer
Methods And
solutions.
Applications
Computer
Simulation of
Foundations
Diffusion Problems
Using the And
Continuous System
Modeling Program
(CSMP) Language
Development and

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Characterization of
Process Simulation Of
Models for
Diffusion and Co-
diffusion of Dopants
in Silicon

The Diffusion of
Innovation in the
Mining Industry

Modelling and
Simulation of
Diffusive Processes
Modelling and
Simulation of

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Silane/air Diffusion Simulation Of Flames

An exact solution exists for the advection-dispersion equation when the wind profile is modeled with a power-law dependence on height. This analytical solution is compared here

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to a numerical simulation of the coupled air-ground system for a leaking

Methods And Applications

underground CO₂ storage. The two methods produced similar results far from the

boundaries, but the boundary conditions had a

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strong effect; the simulation imposed boundary conditions at the edge of a finite domain while the analytic solution imposes them at infinity. The reverse seepage from air to ground was shown in the simulation to be

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very small, and the sharp contrast between time scales suggests that air and ground can be modeled separately, with gas emissions from the ground model used as inputs to the air model.

In this study an

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Processes
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Foundations
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analytical and
numerical
modeling of the
interaction
between the
processes of
diffusion and the
mechanics of a
solid are
developed. It is
then implemented
on a fiber
composite

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material, and several cases are simulated and analyzed. Starting with the a free energy as a function of the deformation and concentration, $[\Psi](F, C)$, a constitutive model is derived for the strain energy

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respectively.

These are then used in the balance of mass, the balance of linear momentum and the continuity equation. The equations are discretized using a finite difference scheme for the time variable, and

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a nonlinear finite element method for the spacial variables. The coupling is implemented using a staggering methodology. The staggering scheme allows for easy implementation and provides a convenient

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framework.
Several
phenomena are
modeled, for
example, strain-
dependent
diffusivity,
concentration
based saturation,
diffuso-elasticity
and nonuniform
diffusion induced
swelling. The

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Modelling And
simulations
Simulation Of
involve various
Diffusive
parametric studies
Processes
including using
Methods And
different elastic
Applications
strain energy
Simulation
functions, such as
Foundations
Kirchhoff Saint
Methods And
Venant. Moreover,
Applications
the simulations are
conducted for both
isotropic and
orthotropic

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materials where
we explore such
effects as free
swelling, and
combined
mechanical
loading and
diffusion boundary
conditions.
A Diffusion
Hydrodynamic
Model
Defects and

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Modelling And
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Processes
Methods And
Applications
Diffusion Theory
and Simulation III
Diffusive, Models,
and Computer
Analysis
The Drift Diffusion
Equation and Its
Applications in
MOSFET Modeling
Selected Problems
In this
dissertation,
the

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Foundations
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quantitative
and qualitative
aspects of
modeling
shallow water
flow driven
mainly by
gravitational
forces and
dominated by
shear stress,
using an
effective

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equation often referred to in the literature as the diffusive wave approximation of the shallow water equations (DSW) are presented. These flow conditions arise for

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Applications
Foundations
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Applications

example in
overland flow
and water flow
in vegetated
areas such as
wetlands. The
DSW equation
arises in
shallow water
flow models
when special
assumptions are
used to

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Applications
Simulation
Foundations
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simplify the
shallow water
equations and
contains as
particular
cases: the
Porous Medium
equation and
the time
evolution of
the p-
Laplacian. It
has been

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Foundations
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Applications

successfully
applied as a
suitable model
to simulate
overland flow
and water flow
in vegetated
areas such as
wetlands; yet,
no formal
mathematical
analysis has
been carried

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Processes
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Applications
Simulation
Foundations
Methods And
Applications

out addressing,
for example,
conditions for
which weak
solutions may
exist, and
conditions for
which a
numerical
scheme can be
successful in
approximating
them. This

Where To
Download
Modelling And
thesis
Simulation Of
represents a
Diffusive
first step in
Processes
that direction.
The outline of
Mathematical
the thesis is
Applications
as follows.
Simulation
First, a survey
Foundations
of relevant
Methods And
results coming
Applications
from the
studies of
doubly

Where To
Download
Modelling And
nonlinear
Simulation Of
diffusion
Diffusive
equations that
Processes
can be applied
Methods And
to the
DSW equation
when

Simulation
topographic
Foundations
effects are
Methods And
ignored, is
Applications
presented.

Furthermore, an
original proof

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Simulation Of
Diffusive
Processes
Methods And
Applications
Simulation
Foundations
Methods And
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of existence of
weak solutions
using
constructive
techniques that
directly lead
to the
implementation
of numerical
algorithms to
obtain
approximate
solutions is

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Simulation Of
Diffusive
Processes
Methods And
Applications

shown. Some
regularity
results about
weak solutions
are presented
as well.

Simulation
Foundations
Methods And
Applications

Second, a
numerical
approach is
proposed as a
means to
understand some
properties of

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Processes
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Applications
Simulation
Foundations
Methods And
Applications
Galerkin
methods will
succeed in

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Diffusive
Processes
Methods And
Applications
Simulation Of
Boundary
Methods And
Applications

approximating
these weak
solutions are
established.
The Diffusion
Hydrodynamic
Model (DHM), as
presented in
the 1987 USGS
publication,
was one of the
first
computational

Where To
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Modelling And
Simulation Of
fluid dynamics
computational
Diffusive based
Processes
on the
groundwater
Methods And
program
Applications
MODFLOW, which
Simulation
evolved into
Foundations
the control
Methods And
volume modeling
Applications
approach. Over
the following
decades, others

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Diffusive
Processes
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Applications
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Foundations
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developed
similar
computational
programs that
either used the
methodology and
approaches
presented in
the DHM
directly or
were its
extensions that
included

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Methods And
Applications
Simulation
Foundations
Methods And
Applications

additional
components and
capacities. Our
goal is to
demonstrate
that the DHM,
which was
developed in an
age preceding
computer graphi
cs/visualizatio
n tools, is as
robust as any

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of the popular
models that are
currently used.

We thank the
USGS for their
approval and
permission to
use the content
from the
earlier USGS
report.

Modeling and
simulation of

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Simulation Of
Diffusive
Processes
Methods And
Applications
Simulation
Modeling and
Simulation of
Spin-polarized
Transport at
the Kinetic and
Diffusive Level

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Modelling And
Simulation of
Diffusive
Lithium
Evaporation
Onto the NSTX
Vessel Walls
A Nodal
Diffusion Model
for the
Simulation of
Xenon
Oscillations
Simulation of

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Modelling And
Diffusion And
Simulation Of
Limited
Diffusive
Aggregation
Models and
Related Results

***This paper
generates an
organization-task
interdependent
network model
based upon
functional
dependence***

Where To
Download
Modelling And
*between tasks and
executive
dependence
between
organizations and
tasks in an complex
product research
and development
(R&D) project. Then
it develops and
simulates the
dynamic model of
technical risk
diffusion by*

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Modelling And

*analyzing the
interaction between*

organizations and

tasks when facing

with technical risks.

The results show

that the technical

risk diffusion

caused by a few

tasks can

significantly

turbulent the

network in a short

time; the diffusion

Where To

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Modelling And

Simulation Of

process has three stages: slow stage,

out of control stage,

and relatively stable

stage; the

relationship

between the

organization

network scale and

the consequence of

diffusion shows

approximate

“inverse U” shape;

the more even

Where To
Download
Modelling And
executive
Simulation Of
dependence, the
Diffusion Of
weaker the
Processes
robustness of the
Methods And
network when fixes
Applications
the number of
Simulation
organizations; there
Foundations
exists a best level of
Methods And
resource input
Applications
which makes the
impact of diffusion
remain at the lowest
level; there is no
significant

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***difference in the
simulation of
diffusion process
under different
attack strategies.***

***This research enriches
the dynamic theory
of risk diffusion, and
has provided
reference for
optimization of
complex product
development project
architecture and
improving the risk***

Where To
Download

*resisting capacity of
R&D projects.*

*To be perfect does
not mean that there
is nothing to add,
but rather there is
nothing to take away*
**Antoine de Saint-
Exupery The drift-
diffusion**

*approximation has
served for more
than two decades as
the cornerstone for*

Where To
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Modelling And
***the numerical
simulation of
semiconductor
devices. However,
the tremendous
speed in the
development of the
semiconductor
industry demands
numerical
simulation tools that
are efficient and
provide reliable
results. This makes***

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the development of a simulation tool an interdisciplinary task in which physics, numerical algorithms, and device technology merge. For the sake of an efficient code there are trade-offs between the different influencing factors. The numerical

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performance of a program that is highly flexible in device types and the geometries it covers certainly cannot compare with a program that is optimized for one type of device only. Very often the device is sufficiently described by a two dimensional

Where To Download

geometry. This is the case in a MOSFET, for example, if the gate length is small compared with the gate width. In these cases the geometry reduces to the specification of a two-dimensional device. Here again the simplest geometries, which

Where To Download

***are planar or at least
rectangular***

***surfaces, will give
the most efficient
numerical codes.***

***The device engineer
has to decide***

***whether this
reduced description
of the real device is
still suitable for his
purposes.***

***Proceedings of
POLYMODEL 4, the***

Where To
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***Fourth Annual
Conference of the
North East
Polytechnics***

***Mathematical
Modelling and
Computer***

***Simulation Group,
Held at Sunderland
Polytechnic in May***

1981

***Multi-scale Modeling
and Finite Element
Simulation of***

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***Diffusion in Porous
Media***

***Modeling and
Simulation of***

***Diffusion Bonding
and Interface***

***Properties of Long
Fiber Reinforced***

***NiAl Composites
Modeling and***

***Simulation of
Transient Enhanced***

***Diffusion Based on
Interactions of Point***

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Modelling And
***and Extended
Simulation Of
Numerical Methods
for Diffusion
Phenomena in
Building Physics***

We adapt the
evolutionary
stock market
model from
Evstigneev,
Hens, Schenk-
Hoppeacute;

Where To
Download
Modelling And
(2006) to a
Simulation Of
continuous time
Diffusive
framework,
Processes
where
Methods And
uncertainty in
Applications
dividends is
Simulation
produced by a
Foundations
single Wiener
Methods And
process. The
Applications
setup is
therefore
significantly
different from

Where To

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Yang and Ewald

(2008), who

also study

continuous

time, but

remain within

the framework

of random

dynamical

systems of non-

diffusive type.

For the case of

fix-mix

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Processes
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Applications
Simulation
Foundations
Methods And
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strategies we
derive the
stochastic
differential
equation which
determines the
evolution of
the wealth
processes of
the various
market players.
These
stochastic

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differential equations are highly non-linear and we find that it is impossible to solve them analytically. Instead we simulate the wealth dynamic for various initial setups

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Processes
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Applications
Simulation
Foundations
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of the market.
A detailed
discussion of
our
observations
from the
simulations is
given.
A model for
simulating the
diffusive
evaporation of
lithium into a

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Applications
Simulators
Foundations
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Applications

helium filled
NSTX vacuum
vessel is
described and
validated And
against an
initial set of
deposition
experiments.
The DEGAS 2
based model
consists of a t
hree-

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Foundations
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dimensional
representation
of the vacuum
vessel, the
elastic
scattering
process, and a
kinetic
description of
the evaporated
atoms.

Additional
assumptions are

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Diffusive
Processes
Methods And
Applications

required to
account for
deuterium out-
gassing during
the validation
experiments.

Simulation
Fundamentals
Methods And
Applications

The model
agrees with the
data over a
range of
pressures to
within the
estimated

Where To Download

uncertainties.

Suggestions are made for more discriminating experiments that will lead to an improved model.

Analysis and Numerical Simulation of the Diffusive Wave

Where To
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Modelling And
Simulation Of
Approximation
of the Shallow
Water Equations
Diffusive
Processes
Comparison of
Analytical And
Model to
Applications
Simulation of
Diffusion Plume
from
Methods And
Underground CO2
Applications
Storage
Agent-based
Modeling and

Where To
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Modelling And
Simulation And
Simulation Of
Spatial
Diffusive Model
for Simulation
of Urban Land
Cover Change
From
Experiments via
Mathematical
Modeling to
Numerical
Simulation and
Optimization

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**The articles in
this volume
summarize the
research
results
obtained in the
former SFB 359
"Reactive Flow,
Diffusion and
Transport"
which has been
supported by
the DFG over**

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Mathematical And
Applications
Methods And
Applications

**the period
1993-2004. The
main subjects
are physical-
chemical
processes
sharing the
difficulty of
interacting
diffusion,
transport and
reaction which
cannot be**

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Modelling And

**considered
separately. The**

modeling and

simulation

within this book

is accompanied

by experiments.

This book is the

second edition

of Numerical

methods for

diffusion

phenomena in

Where To
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building
Simulation Of
physics: a
Diffusive
practical
Processes
introduction
Methods And
originally
Applications
published by
Srinivasan
PUCPRESS
Foundations
(2016). It
Methods And
intends to
Applications
stimulate
research in
simulation of
diffusion

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**problems in
Simulation Of
building
Diffusive
physics, by
Processes
providing an
Methods And
overview of
mathematical
Applications
models and
Simulation
numerical
Foundations
techniques
Methods And
such as the
Applications
finite difference
and finite-
element**

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methods
Simulation Of
traditionally
Diffusive
used in building
Processes
simulation
Method And
tools. Nonconve
Applications
ntional
Simulation
methods such
Foundations
as reduced
Methods And
order models,
Applications
boundary
integral
approaches and
spectral

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Simulation Of
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Processes
Methods And
Applications
Foundations
Methods And
Applications

**methods are
presented,
which might be
considered in
the next
generation of b
uilding-energy-
simulation
tools. In this
reviewed
edition, an
innovative way
to simulate**

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Modelling And
**energy and
Simulation Of
hydrothermal
Diffusive
performance
Processes
are presented,
Methods And
bringing some
Applications
light on
innovative
Simulations
approaches in
Predictions
the field.
Methods And
A Computer
Applications
Simulation of
an Advertising
Diffusion Model**

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**Numerical
Simulation of a
Diffusive Type
Evolutionary
Stock Market
Modelations
Stochastic
Modelling of Re
action-Diffusion
Processes
Computer
Simulation
Model for**

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**Diffusion of
Oxygen Into a
Packaged
Liquid Food
System with
Simultaneous
Oxidation of
Ascorbic Acid
Numerical
Modelling in
Diffusion
Convection**

This volume on
Page 86/126

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Modelling And
materials
Simulation Of
engineering
Diffusive
comprises a
Processes
collection of
Methods And
abstracts of recent
Applications
scholarly papers
Simulation
and articles
Foundations
concerning a wide
Methods And
variety of topics
Applications
related to the
effects of structural
defects and

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diffusion in many material areas, including thin-film manufacturing and facing metals.

Multicomponent Diffusion

discusses the multicomponent diffusion of the three phases of matter. The book

Where To Download

is comprised of nine chapters that cover studies of multicomponent diffusion and mass transfer with an emphasis on the chemical characteristics responsible for multicomponent diffusion. Chapter

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Simulation

Foundations

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Applications

1 provides an

introductory

discourse about

multicomponent

diffusion. Chapter

2 discusses binary

diffusion, while

Chapter 3 covers

multicomponent

flux equation. The

measurement of

ternary diffusion

Where To Download

and the estimation of ternary diffusion coefficients are also explained in the book. A chapter then covers the interacting systems, and the subsequent chapter talks about membranes

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without mobile carriers. The text also discusses carrier-containing membranes and the multicomponent mass transfer. The book will be of great use to researchers and professionals

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whose work
requires a good
understanding of
multicomponent
diffusion.

Analysis,
Modeling, and
Simulation of
Diffusion
Processes in Cell
Biology

A Practical

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Multicomponent
Diffusive
Diffusion
Processes
On Modeling and
Methods And
Simulation of
Applications
Industrial Fiber
Simulation
Spinning
Foundations
Processes:
Methods And
Diffusive Effects,
Applications
Electrified Jets and
Turbulent Airflows
Finite Element

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Simulation Of
Convective
Diffusive Heat
Transfer and
Phase
Transformation
with Reference to
Casting Simulation
*This book focuses
on modeling the
anomalous
diffusion*

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phenomena, being ubiquitous in the natural world. Both the microscopic models (stochastic processes) and macroscopic models (partial differential equations) have been built up. The relationships between the two kinds of models are

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clarified, and based on these models, some statistical observables are analyzed. From statistics to mathematics, the built models show their power with their associated applications. This book is important for students to develop basic skills

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*to be able to
succeed in their
future research. In
addition to
introducing the
related models or
methods, it also
provides the
corresponding
applications and
simulation results,
which will attract
more readers
ranging from*

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*mathematicians to
physicists or
chemists, to name
a few.*

*This book
addresses the key
issues in the
modeling and
simulation of
diffusive processes
from a wide
spectrum of
different
applications across*

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*a broad range of
disciplines.*

*Features: discusses
diffusion and
molecular transport
in living cells and
suspended
sediment in open
channels;*

*examines the
modeling of
peristaltic transport
of nanofluids, and
isotachophoretic*

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Modelling And

*separation of ionic
samples in*

microfluidics;

reviews thermal

characterization of

non-homogeneous

media and scale-

dependent porous

dispersion resulting

from velocity

fluctuations;

describes the

modeling of

nitrogen fate and

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*transport at the
sediment-water
interface and
groundwater flow
in unconfined
aquifers;
investigates two-
dimensional solute
transport from a
varying pulse type
point source and
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in human joints;
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simulation.

A Simulation of the

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Multifield Diffusion
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Reactive Flows,
Diffusion and
Transport*

The aim of this thesis is to contribute to the understanding of spin-induced phenomena in electron motion. These phenomena arise when electrons move

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through a
(partially) magnetic
environment, in
such a way that its
magnetic moment
(spin) may interact
with the
surroundings. The
pure quantum
nature of the spin
requires transport
models that deal
with effects like
quantum

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coherence,
entanglement
(correlation) and
quantum
dissipation. On the
meso- and
macroscopic level
it is not yet clear
under which
circumstances
these quantum
effects may
transpire. The
purpose of this

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work is, on the one hand, to derive novel spin transport models from basic principles and, on the other hand, to develop numerical algorithms that allow for a solution of these new and other existing model equations. The thesis consists

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of four parts. The first part has introductory character; it comprises an overview of fundamental spin-related concepts in electronic transport such as the giant-magneto-resistance (GMR) effect, the spin-transfer torque in

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metallic magnetic
multilayers and the
matrix-character of
transport equations
that take spin-
coherent electron
states into account.
Special emphasis is
placed on the
modeling of the
spin-transfer
torque which
represents the
intersection of

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these concepts. In particular, we consider the diffusive Zhang-Levy-Fert (ZLF) model, an exchange-torque model that consists of the Landau-Lifshitz equation and a heuristic matrix spin-diffusion equation. A finite difference

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scheme based on Strang operator splitting is developed that enables a numerical, self-consistent solution of this non-linear system within multilayer structures. Finally, the model is tested by comparison of numerical results

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to recent
experimental data.
Parts two and three
are the thematic
core of this thesis.
In part two we
propose a matrix-
Boltzmann
equation that
allows for the
description of spin-
coherent electron
transport on a
kinetic level. The

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novelty here is a linear collision operator in which the transition rates from momentum k to momentum k' are modeled by a 2×2 Hermitian matrix; hence the mean-free paths of spin-up and spin-down electrons are represented by the eigenvalues of this

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scattering matrix.

After a formal

derivation of the

matrix-Vlasov

equation as the

semi-classical limit

of the one-electron

Wigner equation,

the ensuing kinetic

equation is studied

with regard to

existence,

uniqueness and

positive semi-

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definiteness of a
solution.

Furthermore, the
new collision
operator is
investigated
rigorously and the
diffusion limit $t_c \rightarrow$
0 of the mean
scattering time is
performed. The
obtained matrix
drift-diffusion
equations are an

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improvement over the heuristic spin-diffusive model treated in part one. The latter is obtained in the limit of identical eigenvalues of the scattering matrix. Part three is dedicated to a first step towards the derivation of the matrix collision

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operator,
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introduced in part
Diffusion
two, from first
Processes
principles. For this,
Methods And
we augment the
Applications
von Neumann
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equation of a
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composite
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quantum system
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by a dissipative
term that relaxes
the total state
operator towards
the Born

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approximation.

Under the premise that the relaxation is the dominant process we obtain a hierarchy of non-Markovian master equations. The latter arises from an expansion of the total state operator in powers of the relaxation time τ_r . In the Born-

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Markov limit $\text{tr} \rightarrow 0$

the Lindblad

master equation is

recovered. It has

the same structure

as the collision

operator proposed

in part two

heuristically.

However, the

Lindblad equation

is still a

microscopic

equation; thus the

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next step would be to carry out the semi-classical limit of the result obtained. In part four we perform a numerical study of a quantum-diffusive, two-component spin model of the transport in a two-dimensional electron gas with

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Rashba spin-orbit coupling. This model assumes the electrons to be in a quantum equilibrium state in the form of a Maxwellian operator. We present two space-time discretizations of the model which also comprise the Poisson equation.

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In a first step pure time discretization is applied in order to prove the well-posedness of the two schemes, both of which are based on a functional formalism to treat the non-local relations between spin densities via the chemical potentials. We then

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schemes are first

order in time and

second order in

space. The discrete

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functionals
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introduced are
Diffusion
minimized with the
Processes
help of a conjugate
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gradient-based
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algorithm in which
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the Newton
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method is applied
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to find the desired
line minima.

Modeling and
Simulation of
Diffusion in
Evaporating

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