

**JOSAI
MATHEMATICAL
MONOGRAPHS**

9

2016

Modeling and Simulation in Applied Mathematics

Proceedings
of Annual Workshop
on Modeling and Simulation
in Applied Mathematics

December 20, 2015
JOSAI UNIVERSITY

Edited by
Masahiro FUJITA
Manabu INUMA
Takahiro TSUCHIYA
Hidenori YASUDA



JOSAI UNIVERSITY
GRADUATE SCHOOL OF SCIENCE

List of Special Issues

SCIENCE BULLETIN OF JOSAI UNIVERSITY

- No.1 Convexity, Chaos and Fractals**
Proceedings of the Symposium on Nonlinear Analysis (NLA96), Spring 1996
- No.2 Surgery and Geometric Topology**
Proceedings of the Conference, September 1996
- No.3 Mathematics Applied to Economics and Finance**
Proceedings of the International Conference, February 1997
- No.4 Complex Dynamical Systems**
Proceedings of the Symposium on Non-Linear Analysis (NLA97), May 1997
- No.5 Wavelet, Chaos and Nonlinear PDEs**
Proceedings of the Symposium on Applied Mathematics, September 1997

JOSAI MATHEMATICAL MONOGRAPHS

- JMM 1. CONVEX ANALYSIS AND CHAOS**
Proceedings of the Symposium on Nonlinear Analysis (NLA98), July 1998
Kiyoko NISHIZAWA, editor
- JMM 2. COMPUTER ALGEBRA**
Proceedings of the Symposium on Nonlinear Analysis (NLA99), September 1999
Kiyoko NISHIZAWA, Chair and Editor
- JMM 3. DIFFERENTIAL GEOMETRY**
Proceedings of the Symposium on Differential Geometry, February 2001
Qing-Ming CHENG, editor
- JMM 4. AN ALGORITHMIC STUDY ON BASIC PLANNING PROBLEMS IN OPERATIONS RESEARCH**
Kakuzo IWAMURA
- JMM 5. TEICHMÜLLER SPACE AND RELATED TOPICS**
Proceedings of the Workshop on Geometry, January 2011
Kiyoko NISHIZAWA, editor
- JMM 6. REPRESENTATION THEORY OF ALGEBRAIC GROUPS AND RELATED TOPICS**
Proceedings of the Workshop on Representation Theory, September 2012
Masatoshi IIDA, Takeyoshi KOGISO, Haruko NISHI, editors
- JMM 7. MATHEMATICS AND COMPUTER SCIENCE**
Proceedings of Annual Workshop on Mathematics and Computer Science, March 2014
Masatoshi IIDA, Manabu INUMA, Kiyoko NISHIZAWA, editors
- JMM 8. STATISTICAL SCIENCE AND RELATED TOPICS**
Proceedings of Annual Workshop on Statistical Science and Related Topics, December 2014
Masatoshi IIDA, Manabu INUMA, Kiyoko NISHIZAWA, Takahiro TSUCHIYA, editors
- JMM 9. MODELING AND SIMULATION IN APPLIED MATHEMATICS**
Proceedings of Annual Workshop on Modeling and Simulation in Applied Mathematics, December 2015
Masahiro FUJITA, Manabu INUMA, Takahiro TSUCHIYA, Hidenori YASUDA, editors

**JOSAI
MATHEMATICAL
MONOGRAPHS**

**Modeling and Simulation
in Applied Mathematics**

**9
2016**

Proceedings
of Annual Workshop
on Modeling and Simulation
in Applied Mathematics

December 20, 2015
JOSAI UNIVERSITY

Edited by
Masahiro FUJITA
Manabu INUMA
Takahiro TSUCHIYA
Hidenori YASUDA

JOSAI UNIVERSITY
GRADUATE SCHOOL OF SCIENCE
Keyakidai 1-1, Sakado
Saitama, Japan 350-0295

JOSAI MATHEMATICAL MONOGRAPHS

EDITOR – IN – CHIEF

HIDENORI YASUDA

Graduate school of Science

Josai University

EDITORIAL BOARD

MASAHIRO FUJITA (Josai University)

MANABU INUMA (Josai University)

TAKAHIRO TSUCHIYA (Josai University)

JOSAI MATHEMATICAL MONOGRAPHS

JMM 9. Modeling and Simulation in Applied Mathematics,

Hidenori Yasuda, Program Chair

*Annual Workshop on Modeling and Simulation in Applied Mathematics
held at Josai University on December 20 in 2015*

Contents

| | |
|---|-----|
| <i>Preface</i> | iv |
| <i>Program</i> | v |
| <i>List of Participants</i> | vii |
| ERI NAKAYAMA, TAKAMICHI SUSHIDA AND ICHIRO HAGIWARA, <i>Mathematical Modeling and Simulation for Origami Tsunami Pod</i> | 3 |
| SENNOSUKE WATANABE AND YOSHIHIDE WATANABE, <i>Bland's rule for the Network Simplex Algorithm</i> | 21 |
| MASAHISA TABATA, <i>Numerical simulation of the behavior of three rising bubbles by an energy-stable finite element scheme</i> | 31 |
| REI TATSUMI, OSAMU KOIKE AND YUKIO YAMAGUCHI, <i>Mesoscale modeling of colloidal suspensions with adsorbing solutes</i> | 43 |
| KAZUKI AKAMATSU, SHOSUKE KANASUGI, MASAHIRO FUJITA AND SHIN-ICHI NAKAO, <i>Numerical simulation of fouling by particles in dead-end constant-pressure microfiltration</i> | 65 |
| KATSUYUKI HASEGAWA, AKIO NASU AND MASAHIRO FUJITA, <i>Behavior analysis of coating layer particles in cosmetic materials during drying by observation and computational simulation</i> | 75 |
| HIDENORI YASUDA, SHOHJI KAWACHI AND KAZUO SUZUKI, <i>Simulated pathogenesis of severe acute respiratory distress syndrome and leukopenia induced with influenza A/H5N1 virus infection and its treatment with immunoglobulins</i> | 89 |
| HISASHI INABA, <i>Endemic threshold analysis for the Kermack-McKendrick reinfection model</i> | 105 |
| YOSUKE NAKANISHI, YUKITAKA MINESAKI AND YOSHIMASA NAKAMURA, <i>Accurate numerical integration algorithm for the Kepler motion</i> | 135 |
| YUKITAKA MINESAKI, <i>Invariant N-gon relative equilibria of discrete-time $(1 + N)$-body problem with small arbitrary masses</i> | 147 |
| YOSHIHISA MORITA AND NAOYUKI SHINJO, <i>Reaction-diffusion models with a conservation law and pattern formations</i> | 177 |

JOSAI MATHEMATICAL MONOGRAPHS
JMM 9 (2016): Modeling and Simulation in Applied Mathematics

PUBLISHED BY GRADUATE SCHOOL OF SCIENCE,
JOSAI UNIVERSITY,
SAKADO, SAITAMA, 350-0295 JAPAN
TEL +81-492-71-7690(OFFICE)
FAX +81-492-71-7685,7689

EDITORIAL BOARD

EDITOR-IN-CHIEF: HIDENORI YASUDA (Josai University)
EDITOR: MASAHIRO FUJITA (Josai University)
MANABU INUMA (Josai University)
TAKAHIRO TSUCHIYA (Josai University)

PRINTED BY GAITAME PRINGING CO., LTD.
29-6, ASAKUSA 2-CHOME, TAITO-KU, TOKYO
111-0032 JAPAN
TEL 03-3844-3855

Copyright © 2016 Josai University
All Rights Reserved

JOSAI MATHEMATICAL MONOGRAPHS

JMM 9. Modeling and Simulation in Applied Mathematics, Hidenori Yasuda, Program Chair

*Annual Workshop on Modeling and Simulation in Applied Mathematics
held at Josai University on December 20 in 2015*

Contents

| | |
|---|-----|
| <i>Preface</i> | iv |
| <i>Program</i> | v |
| <i>List of Participants</i> | vii |
| ERI NAKAYAMA, TAKAMICHI SUSHIDA AND ICHIRO HAGIWARA, <i>Mathematical Modeling and Simulation for Origami Tsunami Pod</i> | 3 |
| SENNOSUKE WATANABE AND YOSHIHIDE WATANABE, <i>Bland's rule for the Network Simplex Algorithm</i> | 21 |
| MASAHISA TABATA, <i>Numerical simulation of the behavior of three rising bubbles by an energy-stable finite element scheme</i> | 31 |
| REI TATSUMI, OSAMU KOIKE AND YUKIO YAMAGUCHI, <i>Mesoscale modeling of colloidal suspensions with adsorbing solutes</i> | 43 |
| KAZUKI AKAMATSU, SHOSUKE KANASUGI, MASAHIRO FUJITA AND SHIN-ICHI NAKAO, <i>Numerical simulation of fouling by particles in dead-end constant-pressure microfiltration</i> | 65 |
| KATSUYUKI HASEGAWA, AKIO NASU AND MASAHIRO FUJITA, <i>Behavior analysis of coating layer particles in cosmetic materials during drying by observation and computational simulation</i> | 75 |
| HIDENORI YASUDA, SHOHJI KAWACHI AND KAZUO SUZUKI, <i>Simulated pathogenesis of severe acute respiratory distress syndrome and leukopenia induced with influenza A/H5N1 virus infection and its treatment with immunoglobulins</i> | 89 |
| HISASHI INABA, <i>Endemic threshold analysis for the Kermack-McKendrick reinfection model</i> | 105 |
| YOSUKE NAKANISHI, YUKITAKA MINESAKI AND YOSHIMASA NAKAMURA, <i>Accurate numerical integration algorithm for the Kepler motion</i> | 135 |
| YUKITAKA MINESAKI, <i>Invariant N-gon relative equilibria of discrete-time $(1 + N)$-body problem with small arbitrary masses</i> | 147 |
| YOSHIHISA MORITA AND NAOYUKI SHINJO, <i>Reaction-diffusion models with a conservation law and pattern formations</i> | 177 |
