

# **8th International Workshop on Multi-Rate Processes and Hysteresis and the 3rd International Workshop on Hysteresis and Slow-Fast Systems (MURPHYS-HSFS 2016)**

Journal of Physics: Conference Series Volume 811

Barcelona, Spain  
13 – 17 June 2016

## **Editors:**

**Pavel Gurevich  
Andrei Korobeinikov**

**Dmitrii Rachinskii  
Vladimir Sobolev**

ISBN: 978-1-5108-3719-5  
ISSN: 1742-6588

**Printed from e-media with permission by:**

Curran Associates, Inc.  
57 Morehouse Lane  
Red Hook, NY 12571



**Some format issues inherent in the e-media version may also appear in this print version.**

Copyright© (2016) by the Institute of Physics  
All rights reserved. The material featured in this book is subject to  
IOP copyright protection, unless otherwise indicated.

Printed by Curran Associates, Inc. (2017)

For permission requests, please contact the Institute of Physics  
at the address below.

Institute of Physics  
Dirac House, Temple Back  
Bristol BS1 6BE UK

Phone: 44 1 17 929 7481  
Fax: 44 1 17 920 0979

[techtracking@iop.org](mailto:techtracking@iop.org)

**Additional copies of this publication are available from:**

Curran Associates, Inc.  
57 Morehouse Lane  
Red Hook, NY 12571 USA  
Phone: 845-758-0400  
Fax: 845-758-2633  
Email: [curran@proceedings.com](mailto:curran@proceedings.com)  
Web: [www.proceedings.com](http://www.proceedings.com)

# Table of contents

## Volume 811

**8th Workshop on Multi-Rate Processes and Hysteresis and the HSFS Workshop  
(Hysteresis and Slow-Fast Systems)**

**13–17 June 2016, Barcelona, Spain**

**Accepted papers received: 14 February 2017**

**Published online: 3 March 2017**

### **Preface**

011001

OPEN ACCESS

[8th Workshop on Multi-Rate Processes and Hysteresis and the HSFS Workshop  
\(Hysteresis and Slow-Fast Systems\)](#)

011002

OPEN ACCESS

[Peer review statement](#)

### **Papers**

012001

OPEN ACCESS

[Slow and fast diffusion in a lead sulphate gravity separation process](#)

Vincent Cregan and William T. Lee.....1

012002

OPEN ACCESS

[Conditions for the critical phenomena in a dynamic model of an electrocatalytic reaction](#)

Natalia Firstova and Elena Shchepakina.....13

012003

OPEN ACCESS

[Weak periodic solutions of  \$xx + 1 = 0\$  and the Harmonic Balance Method](#)

J D García-Saldaña and A Gasull.....21

012004

OPEN ACCESS

[Modeling cancer evolution: evolutionary escape under immune system control](#)

Andrei Korobeinikov, Konstantin E Starkov and Paul A Valle.....32

012005

OPEN ACCESS

[A continuous phenotype space model of cancer evolution](#)

David Masip and Andrei Korobeinikov.....40

012006

OPEN ACCESS

[Nonlinearization and waves in bounded media: old wine in a new bottle](#)

Michael P Mortell and Brian R Seymour.....47

012007

OPEN ACCESS

[An asymptotic analysis of the laminar-turbulent transition of yield stress fluids in pipes](#)

Tim G. Myers, Sarah L. Mitchell and Paul Slatter.....57

012008

OPEN ACCESS

[Asymptotic analysis of reaction-diffusion-advection problems: Fronts with periodic motion and blow-up](#)

Nikolay Nefedov.....71

012009

OPEN ACCESS

[Regularization of the matrix Riccati equation in optimal estimation problem with low measurement noise](#)

Mikhail Osintcev and Vladimir Sobolev.....78

012010

OPEN ACCESS

[Order reduction for a model of marine bacteriophage evolution](#)

Silvia Pagliarini and Andrei Korobeinikov.....84

012011

OPEN ACCESS

[A model of hysteresis arising from social interaction within a firm](#)

Luis A Rios, Dmitrii Rachinskii and Rod Cross.....92

012012

OPEN ACCESS

[On the rationale for hysteresis in economic decisions](#)

Luis A Rios, Dmitrii Rachinskii and Rod Cross.....104

012013

OPEN ACCESS

[Use of Prandtl-Ishlinskii hysteresis operators for Coulomb friction modeling with presliding](#)

Michael Ruderman and Dmitrii Rachinskii.....113

012014

OPEN ACCESS

[Meshless methods for 'gas – evaporating droplet' flow modelling](#)

Oyuna Rybdylova and Sergei S Sazhin.....123

012015

OPEN ACCESS

[Positively invariant manifolds: concept and applications](#)

Sergei S. Sazhin, Elena Shchepakina and Vladimir Sobolev.....135

012016

OPEN ACCESS

[Stable/unstable slow integral manifolds in critical cases](#)

Elena Shchepakina.....143

012017

OPEN ACCESS

[One Critical Case in Singularly Perturbed Control Problems](#)

Vladimir Sobolev.....154

012018

OPEN ACCESS

[An asymptotic solution to a passive biped walker model](#)

Sergey A Yudaev, Dmitrii Rachinskii and Vladimir A Sobolev.....161