

THE PROCEEDINGS OF THE
2016 INTERNATIONAL CONFERENCE
ON BOND GRAPH MODELING AND
SIMULATION
(ICBGM'2016)

Edited by
Dean C Karnopp
Jose J. Granda

SIMULATION SERIES
VOLUME 48
NUMBER 10

Palais des Congres de Montreal
(Montreal Convention Center)
Montreal, Quebec, Canada

JULY 24-27, 2016

SCS

THE SOCIETY FOR MODELING AND SIMULATION INTERNATIONAL
ISBN: 978-1-5108-2425-6

Printed from e-media with permission by:

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



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

© 2016 SIMULATION COUNCILS, INC.

Responsibility for the accuracy of all statement in each paper rests solely with the author(s). Statements are not necessarily representative of, nor endorsed by, The Society for Modeling and Simulation International.

Printed by Curran Associates, Inc. (2016)

Permission is granted to photocopy portions of this publication for personal use and for the use of students provided credit is given to the conference and publication. Permission does not extend to other types of reproduction nor to copying for incorporation into commercial advertising nor for any other profit-making purpose. Other publications are encouraged to include 300- to 500-word abstracts or excerpts from any paper contained in this book, provided credits are given to the author and the conference. For permission to publish a complete paper write: The Society for Modeling and Simulation International (SCS), 2598 Fortune Way, Suite I, San Diego, CA 92081, USA.

Additional copies of the Proceedings are available from:

Curran Associates, Inc.
57 Morehouse Lane
Red Hook, NY 12571
curran@proceedings.com
www.proceedings.com/0128.html

or

The Society for Modeling
and Simulation International
2598 Fortune Way, Ste I
Vista, CA 92081 USA
www.scs.org

ISBN: 978-1-5108-2425-6
PRINTED IN THE UNITED STATES

TABLE OF CONTENTS

BOND GRAPH THEORY I

Numerical Integration Solution of Stationary Power Systems Induced by the Port-based Approach	3
<i>I. Nunez-Hernandez, P. Breedveld, P. Weustink, G. Gonzalez-A</i>	
Structuring Residuals by Faults Structural Decoupling from Bicausal Diagnostic Bond Graph	11
<i>K. Sia, A. Namaane, N. M'Sirdi</i>	
Extension of Lagrangian-Hamiltonian Mechanics: Umbra Poisson Bracket Using Bond Graphs	25
<i>V. Rastogi</i>	
Bond Graph Models for Reconstruction of Vehicle Barrier Equivalent Speeds	35
<i>J. Granda, T. Gloekler</i>	
A Physically Intuitive Yaw-Plane Bond Graph Model for Vehicle Active Safety System Design	48
<i>D. Rideout, P. Pooyafar</i>	
Modeling Ground Vehicles with Active Suspension Kinematics using Bond Graphs.....	54
<i>A. Beckerman, F. Assadian</i>	

MECHANICAL SYSTEMS

Bond Graph Analysis of an Electromechanical Actuator for use in Automotive Suspensions.....	67
<i>D. Karnopp</i>	
Analysis of Stick-Slip Friction between the Drillstring and Borehole Wall in Horizontal Wells	72
<i>M. Sarker, D. Rideout, S. Butt</i>	
Practical Considerations of Bond Graph Causality for Physical Systems with Nonlinear Geometry	79
<i>D. Margolis</i>	

ROBOTICS

Active Vibration Control Modeling in Bond Graph for Underwater Flexible Single Arm Robotic Manipulator	87
<i>S. Kumar, V. Rastogi, P. Gupta</i>	
Morpheus Planetary Lander Liquid Propellant Fluid Slosh Modeling and Simulation Methods	92
<i>J. Granda, L. Nguyen, T. Carlson, S. Brocker, G. Sahragard-Monfared, E. Fornalski</i>	
Multi-body Dynamics Modeling & Control of Quadrotor Helicopter using Bond Graph	102
<i>M. Hossain, N. Krouglicof</i>	

CONTROL SYSTEMS AND ELECTRONICS

Modeling and Simulation of Cervical Region of Spine Using Bond Graphs.....	115
<i>P. Tyagi, V. Rastogi, A. Arora</i>	
Design of an Anti-Tip-Over Control for Counterbalance Forklifts Using Bond Graph Models.....	122
<i>A. Bermejo, J. Felez</i>	

BOND GRAPH THEORY II

Definition of Essential Order on Descriptor Systems and its Bond Graph Determination	133
<i>J. Lagnier, D. Remond, D. Eberard, M. Di Loreto, W. Marquis-Favre</i>	
Implementation and Simulation of Dynamic Models: A Concise Reading of the Relationships Bond Graphs - Block Diagrams	142
<i>A. Fakri, P. Poulichet</i>	
The Theory of Bond Graphs in Distributed Systems and Simulations.....	147
<i>S. Skjong, E. Pedersen</i>	

THERMODYNAMICS AND ENERGY

A New Convection Bond Element for Multiphase Flow Through a Channel	159
<i>F. Brown</i>	
Modeling of Selective Catalytic Reduction Injection System using Bond Graphs for Real Time Simulations	169
<i>F. Assadian, G. Abapo, A. Beckerman</i>	
Paynter Collected Work	181
<i>J. Juarez</i>	

FLUIDICS

Bond Graph Modeling and Simulation of Liquid Metal Sloshing in Ladle	191
<i>A. Roy, A. Saha</i>	
Bond Graph Representation of Convection by Fluid Flow Along an Elastic Surface	198
<i>P. Breedveld, A. Zanj</i>	
Dynamic Analysis of a Deep Water Marine Riser using Bond Graphs	204
<i>R. Reyes, G. Rideout, S. Butt</i>	

ENERGY GENERATION

Bond Graph for Modeling and Diagnostics of Proton Exchange Membrane Fuel Cell	215
<i>M. Bressel, M. Jha, B. Ould-Bouamama, M. Hilairret, D. Hissel</i>	
Bond Graphs Aided Development of Mechanical Power Transmission for Aerospace Electromechanical Actuators	221
<i>C. Coic, J. Fu, J. Mare</i>	
Author Index	