

**PROCEEDINGS OF THE
2021 INTERNATIONAL CONFERENCE
ON BOND GRAPH MODELING AND
SIMULATION
(ICBGM'2021)**

**Editors
Dean C Karnopp
José J. Granda**

**SIMULATION SERIES
VOLUME 53
NUMBER 3**

**HACIENDA HOTEL OLD TOWN
SAN DIEGO, CALIFORNIA USA
NOVEMBER 8-10, 2021
SCS**

**THE SOCIETY FOR MODELING AND SIMULATION INTERNATIONAL
ISBN: 978-1-7138-3946-0**

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.

© 2021 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 with permission by Curran Associates, Inc. (2021)

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
11315 Rancho Bernardo Road, Suite 139
San Diego, CA 92127 USA
www.scs.org

ISBN: 978-1-7138-3946-0
PRINTED IN THE UNITED STATES

CONTENTS

Page

Author(s)

BOND GRAPH THEORY I

Achieving Desired Modal Damping Ratios in Lumped Segment Continuous System Models

7

Geoff Rideout

C-Field Representation Of Compliance In Lumped-Parameter Finite-Mode Representations Of Continuous Systems With Multiple Force Inputs

15

Layne Clemen , Donald Margolis

BOND GRAPH THEORY II

Bond Graph Modelling and Dynamics of a Power Regenerative Hydrostatic Transmission Dynamometer

27

*Biswaranjan Mohanty,
Kim A. Stelson,*

Increasing Complexity Vehicle Models for Analyzing and Designing Automotive Control Systems

35

*Gladys Abapo Donovan,
Donald Margolis*

VEHICLES AND TRANSPORTATION SYSTEMS I

Inertial Force Actuator Applications to Active Vehicle Suspensions

46

Jordan McCrone, Donald Margolis

Modeling motion sickness using a four-wheel vehicle model augmented with a passenger model

57

*Eunil Kim
Ali Akbari,
Donald Margolis*

Bond Graph Modeling of a Planar Vehicle with Electric Traction Motors for Assisted Torque-Vectoring,

67

*Donghun Lee,
Johnathan Loyola,
Donald Margolis*

MECHANICAL SYSTEMS

- | | | |
|--|----|--|
| Calculation Of Torque And Drag In Directional Drilling Using A Multi-Body Bond Graph Approach | 76 | <i>M.K.S. Liyanarachchi, Geoff Rideout, Sampath Liyanarachchi,</i> |
| A Bond Graph Representation of the Sagittal Spine for Estimation of Ride Comfort | 85 | <i>Ali Akbari, Donald Margolis</i> |

VEHICLES AND TRANSPORTATION SYSTEMS II

- | | | |
|--|-----|---|
| Advanced Steering Stability Controls For Articulated Vehicles By Using Bond Graphs And Model Predictive Control | 98 | <i>Jesus Felez, Alvaro Lopez-Mendez</i> |
| Modeling and Simulation of Heavy Vehicles Air Brakes Applicable Laws of Physics | 111 | <i>Jose Granda</i> |

MECHANICAL SYSTEMS II

- | | | |
|--|-----|--|
| Fatigue Failure Prognosis of an Oil Well Drill String Using a Lumped Segment Bond Graph Model and Finite Element Method | 125 | <i>Mihiran Galagedarage, Geoff Rideout</i> |
| Bond Graph Model of a Fighter Pilot's Breathing Support System | 135 | <i>Raul Longoria, Mark M. Koeroghiana</i> |

CONTROL SYSTEMS AND ELECTRONICS

- | | | |
|--|-----|---|
| Modeling Non-Backdriving Behavior in an Electromechanical Steering Actuator Using Bond Graphs | 149 | <i>Jonathan Loyola, Kyungbok Lee, Donald Margolis</i> |
|--|-----|---|

| | | |
|---|-----|--|
| Active Vibration Control of Two Flexible Link Underwater Manipulator | 161 | <i>Sunil Kumar, Vikas Rastogi, Prabhkiran Kaur</i> |
| Bond Graph Modeling Of Brake-By-Wire Actuators On A One-Wheel Vehicle Model | 169 | <i>Ehsan Arasteh, Francis Assadian</i> |
| BOND GRAPH THEORY III | | |
| Comprehensive Dynamic Model of a Cable-Driven Parallel Robot using the Bond Graph Approach | 181 | <i>Ishan Chawla, Pushparaj Mani Pathak, Arun Kumar Samantaray</i> |
| Bond Graph Approach for Modelling of Proton Exchange Membrane Fuel Cell System | 192 | <i>Kamyar Maleki Bagherabadi, Stian Skjong, Eilif Pedersen</i> |
| MULTY-ENERGY SYSTEMS | | |
| Treating Multiphase Channel Flow With THERMOSIM | 205 | <i>Forbes Brown</i> |
| Electric Torque Vectoring Driveline Technology Assessment via Bond Graph Modeling and Simulation | 216 | <i>Jose Velazquez Alcantar, Ming Kuang</i> |
| Dynamic Linearization Of A Synchronous Machine For Control: A Bond Graph Approach | 226 | <i>Raquel S. Rodriguez, Gilberto Gonzalez-Avalos, Noe Barrera Gallegos, Gerardo Ayala Jaimes</i> |