

Proceedings of the ASME

**INTERNATIONAL MECHANICAL ENGINEERING
CONGRESS AND EXPOSITION
- 2020 -**

VOLUME 7A

DYNAMICS, VIBRATION, AND CONTROL

presented at

ASME 2020 INTERNATIONAL MECHANICAL ENGINEERING CONGRESS AND EXPOSITION

NOVEMBER 16-19, 2020

ONLINE

sponsored by

ASME

THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS

Two Park Avenue * New York, NY. 10016

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.

Statement from By-Laws: The Society shall not be responsible for statements or opinions
Advanced in papers. . .or printed in its publications (7.1.3)

INFORMATION CONTAINED IN THIS WORK HAS BEEN OBTAINED BY ASME FROM SOURCES BELIEVED TO BE RELIABLE. HOWEVER, NEITHER ASME NOR ITS AUTHORS OR EDITORS GUARANTEE THE ACCURACY OR COMPLETENESS OF ANY INFORMATION PUBLISHED IN THIS WORK. NEITHER ASME NOR ITS AUTHORS AND EDITORS SHALL BE RESPONSIBLE FOR ANY ERRORS, OMISSIONS, OR DAMAGES ARISING OUT OF THE USE OF THIS INFORMATION. THE WORK IS PUBLISHED WITH THE UNDERSTANDING THAT ASME AND ITS AUTHORS AND EDITORS ARE SUPPLYING INFORMATION BUT ARE NOT ATTEMPTING TO RENDER ENGINEERING OR OTHER PROFESSIONAL SERVICES. IF SUCH ENGINEERING OR PROFESSIONAL SERVICES ARE REQUIRED, THE ASSISTANCE OF AN APPROPRIATE PROFESSIONAL SHOULD BE SOUGHT.

For authorization to photocopy material for internal or personal use under circumstances not falling within the fair use provisions of the Copyright Act, contact the Copyright Clearance Center (CCC), 222 Rosewood Drive, Danvers, MA 01923, Tel: 978-750-8400

Requests for special permission or bulk reproduction should be addressed to permissions@asme.org.

ISBN NO. 978-0-7918-8454-6

© 2020 ASME

All rights reserved.

Printed in U.S.A with permission by Curran Associates, Inc. (2021)

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
Web: www.proceedings.com

CONTENTS

DYNAMICS, VIBRATION, AND CONTROL

CONTROL THEORY AND APPLICATIONS

IMECE2020-23179..... **V07AT07A001**
Augmentation of Fixed Gain Controlled Infinite Dimensional Systems With Direct Adaptive Control
Mark J. Balas

IMECE2020-23370..... **V07AT07A002**
Less Conservative Stability Constraint for Data-Based Feedback Tuning
Weicai Huang, Kaiming Yang, Yu Zhu, Sen Lu, Min Li

IMECE2020-23885..... **V07AT07A003**
On the Uses of Linear-Quadratic Methods in Solving Nonlinear Dynamic Optimization Problems With Direct Transcription
Daniel R. Herber, Athul K. Sundarajan

IMECE2020-24273..... **V07AT07A004**
Delay Scheduling of a LQR and PID Controlled Pendubot Using CTCR Method
Helio S. Esteban Villegas, Carlos Borrás Pinilla, Nejat Olgac

IMECE2020-24447..... **V07AT07A005**
Advanced Control Techniques for Semi-Active Suspension Systems
Jessica Gissella Maradey Lazaro, Kevin Sebastian Caceres Mojica, Silvia Juliana Navarro Quintero

DESIGN AND CONTROL OF ROBOTS, MECHANISMS, AND STRUCTURES

IMECE2020-23105..... **V07AT07A006**
Re-Sizable Quadrupedal Robot Platform: HARQ
Kiwon Sohn, Salman Hussain, Matthew Bradnan, Owen May

IMECE2020-23106..... **V07AT07A007**
Mobile Carrying Platform: i-Explore
Kiwon Sohn, Aurian Emami, Jaesung Yang

IMECE2020-23138..... **V07AT07A008**
Development of a 3D Printed Soft Parallel Robot
Martin Garcia, Amir Ali Amiri Moghadam, Ayse Tekes, Randy Emert

IMECE2020-23151..... **V07AT07A009**
Kit Based Motion Generator for a Soft Walking Robot
Lars Schiller, Duraikannan Maruthavanan, Arthur Seibel, Josef Schlattmann

IMECE2020-23569	V07AT07A010
Model Predictive Control of Double Stacked Suspension System	
<i>Nathan Batta, Daniel Doscher</i>	
IMECE2020-23570	V07AT07A011
Analysis and Design of an Auxiliary Catching Arm for an Apple Picking Robot	
<i>Andrew Porter, Jassim Alhamid, Changki Mo, John Miller, Joseph Iannelli, Marcel Honegger, Lukas Lichtensteiger</i>	
IMECE2020-23607	V07AT07A013
Solar Tracking Using Linear Actuator	
<i>Jay Dipak Betai, Hong Zhou</i>	
IMECE2020-23661	V07AT07A014
Development of Prototype of Two Axis Gimbal-Type Platform in Underwater	
<i>Hoonmin Park, Hyunjae Lee, Hongryul Ryu, Dongho Kim, Hyunsoo Kim, Hyesoo Park, Sangryong Lee, Hak Yi</i>	
IMECE2020-23904	V07AT07A015
Automated Drilling of High Aspect Ratio, Small Diameter Holes in Remote, Confined Spaces	
<i>Michal Rittikaidachar, Clint Hobart, Jonathon E. Slightam, Jiann-Cherng Su, Stephen P. Buerger</i>	
IMECE2020-23947	V07AT07A016
Modelling and Control of a Translational Robotic Arm	
<i>Bin Wei</i>	
IMECE2020-23964	V07AT07A017
Trajectory Control of Robotic Manipulators: A Comparison Study	
<i>Ho-Hoon Lee</i>	
IMECE2020-24112	V07AT07A018
Design and Build a T-Shirt Cannon Firing Mechanism	
<i>Kyle Norvell, Michael McClelland, Ethan Ratajczak, Janet Dong</i>	
IMECE2020-24137	V07AT07A019
Design and Experimental Validation of a LQG Control System for the Stabilization of a 2DOF Commercial Gimbal Using Physical Modelling Techniques	
<i>Julian Andres Gomez Gomez, Camilo E. Moncada Guayazan, Sebastian Roa Prada, Hernando Gonzalez Acevedo</i>	

IMECE2020-24148..... **V07AT07A020**
Nonlinear Control Design for a Gravity Compensation Mechanism for Human Lower Limb Rehabilitation
Zeki Okan Ilhan, Meng-Sang Chew

IMECE2020-24665..... **V07AT07A021**
Modelling, Control and Design of a Clutched Parallel Elastically Actuated Articulated Robotic Leg Through Virtual Tunable Damping
Emre Tanfener, Sinan Sahin Candan, Ali Emre Turgut, Uluc Saranli

DYNAMICS AND CONTROL IN MICRO/NANO ENGINEERING

IMECE2020-23916..... **V07AT07A022**
ROM of Superharmonic Resonance of Fourth Order of Electrostatically Actuated Clamped MEMS Circular Plates: Voltage Response
Dumitru I. Caruntu, Julio Beatriz

IMECE2020-24178..... **V07AT07A023**
Dynamics of MEMS-Based Angular Rate Sensors Excited via External Electrostatic Forces
Ibrahim F. Gebrel, Ligang Wang, Samuel F. Asokanathan

IMECE2020-24357..... **V07AT07A024**
3D Printed MEMS-Scale Vibration Isolators
Arthur Bond, Brent D. Bottenfield, Robert N. Dean, Mark L. Adams, Jing Zhao, XiaoFu Li, George T. Flowers, Edmon Perkins

DYNAMICS AND CONTROL OF SOFT STRUCTURES

IMECE2020-23221..... **V07AT07A025**
Soft-Body Simulation With CUDA Based on Mass-Spring Model and Verlet Integration Scheme
Zhou Zhang

FLUID-STRUCTURE INTERACTION

IMECE2020-23356..... **V07AT07A026**
Subsonic Stall Flutter of a Linear Turbine Blade Cascade Using Experimental and CFD Analysis
Vaclav Slama, Bartolomej Rudas, Jiri Ira, Ales Macalka, Petr Eret, Volodymyr Tsybalyuk

IMECE2020-23868..... **V07AT07A027**
Delaying the Chaotic Onset in the Flow-Field of Flapping Foil With Flexible Aft Tail
Chhote Lal Shah, Dipanjan Majumdar, Sunetra Sarkar

IMECE2020-23890..... **V07AT07A028**
Nonlinear Fluid-Elastic Behavior of a Flapping Wing With Low-Order Chord-Wise Flexibility
Dipanjan Majumdar, Chandan Bose, Sunetra Sarkar

IMECE2020-24231..... **V07AT07A029**
Simulation of a Hydraulic Pulsation Dampener Used for Pulsation Reduction Induced
by Vibrations in a Hydraulic System
William Von Dolln, Shanzhong (Shawn) Duan

IMECE2020-24235..... **V07AT07A030**
Nonlinear Vibrations of Model PWR Fuel Assemblies: Part 1 -- Experimental Setup
and Measurements
*Giovanni Ferrari, Giulio Franchini, Prabakaran Balasubramanian, Kostas Karazis, Marco
Amabili*

IMECE2020-24265..... **V07AT07A031**
Nonlinear Vibrations of Model PWR Fuel Assemblies: Part 2 -- Interpretation of
Results Using Bilinear Stiffness Model
*Prabakaran Balasubramanian, Giovanni Ferrari, Giulio M. Franchini, Marco Amabili, Kostas
Karazis, Brian Painter*

GENERAL DYNAMICS, VIBRATION, AND CONTROL

IMECE2020-23087..... **V07AT07A032**
An Eigensystem Realization Algorithm for Modal Parameter Identification of a
Vertical-Shaft High-Speed Centrifugal Machine
Sina Piramoon, Mohammad A. Ayoubi

IMECE2020-23095..... **V07AT07A033**
Robustness Analysis of Parallel Feedforward Control With Derivative (PFCD) Method
Keyvan Noury, Bingen Yang

IMECE2020-23096..... **V07AT07A034**
A Pseudo S-Plane Mapping of Z-Plane Root Locus
Keyvan Noury, Bingen Yang

IMECE2020-23259..... **V07AT07A035**
Vibration Suppression for Large-Scale Flexible Structures Using Deep Reinforcement
Learning Based on Cable-Driven Parallel Robots
Haining Sun, Xiaoqiang Tang, Jinhao Wei

IMECE2020-23293..... **V07AT07A036**
Research on Dynamic Characteristics of the High-Speed Cable Force Transmission
Senhao Hou, Xiaoqiang Tang, Yuheng Wang, Dianjun Wang

IMECE2020-23343..... **V07AT07A037**
Application of Alternative Support Fixture System in Vibration Suppression of Thin-
Walled Parts
Ze Liu, Yu Sun, Yu Wang

IMECE2020-23386	V07AT07A038
Spin Stabilization of an Air Ambulance Litter <i>Christopher Forden, Yanuel Trinidad, Ryan von Chance-Stutler, Andrew Bellocchio, James Bluman, Mary Lanzerotti</i>	
IMECE2020-23485	V07AT07A039
Simulation and Visualization of Dynamic Systems in Virtual Reality Using SolidWorks, MATLAB/Simulink, and Unity <i>Ismail Akharas, Michael P. Hennessey, Eric J. Tornoe</i>	
IMECE2020-23534	V07AT07A040
Edge Coil Force Fitting and Current Optimal Commutation Algorithm for Magnetic Levitation Planar Motor With Moving Magnet <i>Haobo Sun, Yu Zhu, Kaiming Yang, Sen Lu</i>	
IMECE2020-23551	V07AT07A041
A Comparative Study of Active Control Methods for Mitigation of Torsional Stick-Slip Vibrations in Drillstring Systems <i>Fourat Zribi, Lilia Sidhom, Mohamed Gharib, Shady S. Refaat, Abdelkader Mami</i>	
IMECE2020-23572	V07AT07A042
A Compound Recoil-Compensated Chamber Design for Free-Fall Absolute Gravimeters <i>Yi Wen, Kang Wu, Meiyong Guo, Lijun Wang</i>	
IMECE2020-23671	V07AT07A043
Vibration Suppression of an Elastically Supported Beam With Closely Spaced Natural Frequencies <i>Haizhou Liu, Hao Gao</i>	
IMECE2020-23723	V07AT07A044
Enhance PV Panel Detection Using Drone Equipped With RTK <i>Hesham Ismail, Mohammed Alhussein, Nawal Aljasmi, Saeed Almazrouei</i>	
IMECE2020-23749	V07AT07A045
Dynamic Characteristics of Infants Riding on Stroller <i>Hiroyuki Okajima, Shinichiro Ota, Ryo Ota</i>	
IMECE2020-23773	V07AT07A046
Experimental Investigation of Vibration Damping Behavior of Magneto-Mechanical Coated AISI321 Stainless-Steel <i>Hafiz Muhammad Ashraf, Farhan Ali, Muhammad Imran Sadiq</i>	
IMECE2020-23824	V07AT07A047
Estimation of High-Frequency Vibration Loads in Deep Drilling Systems Using Augmented Kalman Filters <i>Mohamed Ichaoui, Georg-Peter Ostermeyer, Mathias Tergeist, Andreas Hohl</i>	

IMECE2020-24124..... **V07AT07A048**
Bearing Fault Detection and Classification: A Framework Approach
Carlos Fabian Melgarejo Agudelo, John Jairo Blanco Rodriguez, Jessica Gissella Maradey Lazaro

IMECE2020-24146..... **V07AT07A049**
Capacity Fade Estimation of a Lithium-Ion Battery Through an Integrated Electrochemical Battery Model and Empirical Cycle Aging Model
Sohel Anwar

IMECE2020-24330..... **V07AT07A050**
Bearing Housing Design for Vibration Control, Using Tilting Pad Bearings Instead of Lemon-Bore Type on a Gas Turbine
Chippa Anil, Aparna Satheesh, Babu Santhanagopalakrishnan, Marcin Bielecki

IMECE2020-24466..... **V07AT07A051**
Adaptive Iterative Learning Control of Fluidic Muscle Driven Parallel Manipulators for Force Control With Sliding Mode Technique
Xinxin Zhang, Min Li, Huafeng Ding

IMECE2020-24605..... **V07AT07A052**
Control Co-Design for Rotor Blades of Floating Offshore Wind Turbines
Xianping Du, Laurent Burlion, Onur Bilgen