



UDC: 621

ISSN 1451-2092

University of Belgrade
Faculty of Mechanical Engineering

FME TRANSACTIONS

New Series, Volume 51, Number 2, 2023

Editor:

Boško Rašuo

University of Belgrade

Associate Editor:

Stevanović Vladimir

University of Belgrade

Editorial Board:

Avellan François

Swiss Federal Institute of Technology, Zurich, Switzerland

Cizmas Paul

Texas A&M University, College Station, USA

Dulikravich S. George

Florida International University, Miami, USA

Ehmann F. Kornel

Northwestern University, Evanston IL, USA

Fragassa Cristiano

Alma Mater Studiorum - University of Bologna, Italy

Gajić Zoran

Rutgers University, USA

Jakirlic Suad

Technische Universität Darmstadt, Germany

Jemcov Aleksandar

University of Notre Dame, South Bend IN, USA

Jovanović Jasmina

University of Belgrade

Kartnig Georg

Technische Universität Wien, Austria

Komatina Mirko

University of Belgrade

Meerkamm Harald

Friedrich-Alexander-Universität Erlangen-Nürnberg, Germany

Mester Gyula

University of Szeged, Szeged, Hungary

Minak Giangiacomo

Alma Mater Studiorum - University of Bologna, Italy

Moschetta Jean-Marc

ISAE-SUPAERO, University of Toulouse, France

Putnik Goran

University of Minho, Portugal

Radovanović Miroslav

University of Nis

Reddy Sohail R

Naval Postgraduate School, USA

Sedmak Aleksandar

University of Belgrade

Solazzi Luigi

University of Brescia, Italy

Soutis Constantinos

The University of Manchester, Manchester, UK

Stamenović Dimitrije

Boston University, Boston, USA

Vukelic Sinisa

Columbia University, New York, USA

Technical Editor:

Sedmak Simon

University of Belgrade

Published by:

University of Belgrade

Faculty of Mechanical Engineering

The journal is covered in the Emerging Sources Citation Index (ESCI) Clarivate Analytics services.

Volume 51, No 2, 2023, pp. 131 – 272

CONTENTS

	PAGE
Shaimaa H. Kamel, Mohsin N. Hamzah, Saad A. Abdulateef, Qasim A. Atiyah	131
<i>A Novel Design of Smart Knee Joint Prosthesis for Above-Knee Amputees</i>	
Rasha Mohammed Hussein	140
<i>Design a New Hybrid Controller Based on an Improvement Version of Grey Wolf Optimization for Trajectory Tracking of Wheeled Mobile Robot</i>	
San Luis Tolentino	149
<i>Empirical Equation of the Mach Number as a Function of the Stagnation Pressure ratio for a Quasi-one-dimensional Compressible Flow</i>	
Zs. Németh, P. Böröcz	161
<i>Impact Shock Events in Multimodal Container Transshipment for Packaging Testing</i>	
Wael M. Elmayyah, Mostafa M. Samy	169
<i>Reduced Order Model for an Electro-Hydraulic Valve of A Gas Turbine Engine's Controller</i>	
M. Polishchuk, M. Tkach, Y. Kornaga	176
<i>Improvement of the Pneumo-hydraulic Amplifier for Press Machines: Design and Parameter calculation</i>	
Vesna Spasojević Brkić, Branislav Tomić, Martina Perišić, Nemanja Janev	183
<i>Differences in Kaizen Implementation between Countries and Industry Types in Multinational Supply Chain</i>	
Thai Thanh Hiep, Vo Duy Cong, Le Hoai Phuong	192
<i>Model Predictive Collision-Free Path Following Control for Nonholonomic Mobile Robots</i>	
Philipp Trost, Georg Karting, Michael Eder	201
<i>Simulation Study of RCS/R-Systems with Several Robots Serving One Picking Station</i>	

(Contents continued on inside back cover)



**Clarivate
Analytics**

Web of Science™

The Ministry of Education and Science of the Republic of Serbia financially supported the publication of Volume 51, No 2 of this Journal. This support is gratefully acknowledged.

Printed by:
"PLANETA print", Ruzveltova 10, 11000 Belgrade

Aims and Scope:

The journal FME Transactions publishes original scientific, double-blind peer-review papers (reviewing and contributed papers) from all fields of Mechanical Engineering, which is, as a branch of Engineering, considered in the journal in its broadest possible sense. Thus, the articles are welcome from Applied Mechanics, Fluids Engineering, Thermodynamics, Heat, and Mass Transfer, Robotics, Material Science, Tribology, Combustion, Mechanical Design, Machine Dynamics, Production, Industrial, Agricultural, Aerospace, Processing, Railway, Biomedical and Control Engineering, Mechanization, Hydro- and Thermopower Systems, Internal Combustion Engines and Vehicle Dynamics, Energy Resources Technology, Military Technology, Naval Architecture, Applied and Industrial Mathematics, etc.

Theoretical, experimental, and computational analyses of various problems of Mechanical Engineering are equally welcome and acceptable for publication. In addition, there will be published book reviews and, in special issues, selected papers from symposia organized by the Faculty of Mechanical Engineering in Belgrade.

Reviewing papers will be published by invitation only. One volume consists of four numbers.

Instructions for Authors:

An FME Transaction manuscript should be written clearly and concisely in correct English, with assumptions clearly identified, with precise logic, with relevance to the practice described, and with actual accomplishments of the work plainly stated and honestly appraised.

Usually, the length of a reviewing paper is up to 25 pages, and the length of a contributed article is up to 15 pages. All papers are subject to a reviewing process. During the process, the names of referees will be kept confidential to authors, and also the names of authors will remain anonymous to referees. As a rule, the reviewing process should be accomplished in 2-3 months. The final acceptance of a paper for publication in the journal is based on the decision of the Editorial Board.

Template for Manuscript:

<https://www.mas.bg.ac.rs/istrazivanje/fme/start>

Submission of Papers:

Papers intended for publication in FME Transactions should be submitted to the Editor, in electronic form, to the following address:

fme-transactions@mas.bg.ac.rs

or:

Prof. Bosko Rasuo, Editor
brasuo@mas.bg.ac.rs
Faculty of Mechanical Engineering
Kraljice Marije 16,
11120 Belgrade 35
Serbia

On line service:

<http://www.mas.bg.ac.rs/transactions>

ISSN 1451-2092

UDC: 621

Volume 51, No 2, 2023, pp. 131 – 272

CONTENTS CONTINUED

	PAGE
Alexey A. Semenov <i>Method of Strength Analysis for Doubly-Curved Stiffened Orthotropic Shells by Various Strength Theories</i>	211
Ritesh Singh, Om Prakash, Sudhir Joshi <i>Control Design Using PID with State Feedback for Air-Breathing Hypersonic Vehicle</i>	221
Mohammed Abdul Majid, Mohd Salmi M. Noorani, Fatimah Abdul Razak <i>Nonlinear Dynamic Analysis of Meteorological Variables for Ha'il Region, Saudi Arabia, for the Period 1990-2022</i>	231
Ayman Belkhiri, Ammar Amouri, Abdelhakim Cherfia <i>Design of Fractional-Order PID Controller for Trajectory Tracking Control of Continuum Robots</i>	243
Vijay Kumar Patidar, Sudhir Joshi <i>Numerical Analysis of Stagger Supersonic Biplane at Off-Design Condition with Trailing Edge Flap</i>	253
Vaibhav Bisht, VG Sridhar, Mukund Janardhanan <i>An Analysis of Causal Relationships Among Challenges Impeding Adoption of Industry 4.0 Through DEMATEL Technique</i>	262



**Clarivate
Analytics**

Web of Science™