# LODZ UNIVERSITY OF TECHNOLOGY

Volume 22 Number 3, 2018

# Mechanics and Mechanical Engineering

Editor in Chief: Tomasz Kapitaniak

Łódź, Poland

# MECHANICS AND MECHANICAL ENGINEERING International Journal

### Editor in chief – Tomasz Kapitaniak

Mechanics and Mechanical Engineering Editorial Office Division of Dynamics, Lodz University of Technology 90-924 Łódź, Poland, Tel. (48 42) 636 68 22

#### Editorial board

J. Brindley – Leeds

J. Giergiel – Rzeszów

M. Giergiel – Kraków

K. Jóźwik – Łódź

W. Kaniewski – Łódź

M. Królak – Łódź

K. Li - Michigan

J. Manevich – Dniepropetrovsk

A. Nayfeh – Blacksburg

M. S. El Naschie – Cambridge

W. Ostachowicz – Gdańsk

Z. Peradzyński – Warsaw

W.-H. Steeb – Johannesburg

K. E. Thylwe – Stockholm

M. Wiercigroch – Aberdeen

A. Tylikowski – Warsaw

#### Editorial staff:

Anna Jach, anna.jach@p.lodz.pl, Agnieszka Chudzik, agnieszka.chudzik@p.lodz.pl, Jerzy Wojewoda

## Scope of the journal

Mechanics and Mechanical Engineering publishes original papers, notes, and invited review articles from all fields of theoretical and applied mechanics as well as mechanical engineering. In addition to the classical fields, such as Rigid Body Dynamics, Elasticity, Plasticity, Hydrodynamics and Gas Dynamics, it gives special attention to recently developed and boundary areas of mechanics. As a rule, only contributions written in English will be accepted.

 $\begin{array}{c} {\rm ISSN} \ 1428\text{--}1511 \\ {\rm e\text{-}ISSN} \ 2354\text{--}0192 \end{array}$ 

on-line: www.kdm.p.lodz.pl

#### Copyright Tomasz Kapitaniak, 2002-2018

Submission of manuscript implies: that the work described has not been published before (except in the form of an abstract or as part of a published lecture, review, or thesis); that is not under consideration for publication elsewhere; that its publication has been approved by all coauthors, if any, as well as by the responsible authorities at the institute where the work has been carried out; that, if, and when the manuscript is accepted for publication, by authors agree to automatic transfer of the copyright to the publisher; and that the manuscript will not be published elsewhere in any language without consent of the copyright holders.

# CONTENTS

Andrzej Kaczyński and Bartosz Kaczyński	
An Interface Anticrack in a Periodic Two–Layer Piezoelectric Space under Vertically Uniform Heat Flow	667
Dorota Kula, Ewaryst Wierzbicki, Joanna Witkowska-Dobrev and Łukasz Wodzyński	
Fourier Variant Homogenization Treatment of Single Impulse Boundary Effect Behaviour	683
Dorota Pawlus	
Sensitivity of Composite Structure with Directional Properties of Annular Three-Layered Plate Mechanically and Thermally Loaded	691
Ewelina Pazera, Piotr Ostrowski and Jarosław Jędrysiak	
On Thermoelasticity in FGL – Tolerance Averaging Technique	703
Ewaryst Wierzbicki, Dorota Kula and Łukasz Wodzyński	
Fourier Variant Homogenization of the Heat Transfer Processes in Periodic Composites	719
Heorhiy Sulym, Iaroslav Pasternak and Viktoriya Pasternak	
Boundary Element Modeling of Pyroelectric Solids with Shell Inclusions	727
Heorhiy Sulym, Olena Mikulich and Vasyl' Shvabyuk	
Ivestigation of the Dynamic Stress State of Foam Media in Cosserat Elasticity	739
Jarosław L. Bojarski and Ewaryst Wierzbicki	
Asymptotic Behavior of Magnetostrictive Elasticity for Microstructured Materials	s 751
Jakub Marczak	
On the Modeling of Periodic Sandwich Structures with the Use of the Broken Line Hypothesis	761

Łukasz Wodzyński, Dorota Kula and Ewaryst Wierzbicki	
Transport of Temperature Fluctuations Across a Two-Phased Laminate Conductor	775
Barbara Tomczyk and Anna Litawska	
Micro-Vibrations and Wave Propagation in Biperiodic Cylindrical Shells	789
Vazgen Bagdasaryan, Monika Wągrowska and Olga Szlachetka	
Displacements Caused by the Temperature in Multicomponent, Multi-Layered Periodic Material Structures	809

#### INTRODUCTION

Nationwide Symposia "Modelling of Microstructured Media" are organized by the Department of Structural Mechanics of the Lodz University of Technology. The patronage over the Symposia has been taken by the Polish Society of Theoretical and Applied Mechanics.

The latest Symposium was the fifth and it was held in CityplaceLodz, 11-12 October, 2018. The previous Symposia (years 2006, 2008, 2011, 2015) were also held in CityplaceLodz.

The aim of the meetings is to bring together scientists dealing with various problems of microstructured media in order to discuss important results and new ideas in this field. The scope is to present analytical and numerical models for the analysis of static, dynamic, stability and thermal problems for media with microstructure and to discuss results obtained by applications of these models to solving some special modelling problems.

During the latest Symposium, 28 contributions were presented and 40 participants took part in it. Some of these contributions have been extended and accepted for printing in a special issue of the journal Mechanics and Mechanical Engineering. Before printing, each paper has been thoroughly reviewed by a member of the Scientific Committee, according to the requirements imposed by Mechanics and Mechanical Engineering.

We would like to express our gratitude to all Authors for their valuable contributions containing a number of original and interesting results.

 $Stanisław\ Matysiak - Chairman\ of\ Scientific\ Committee$   $Barbara\ Tomczyk - Chairman\ of\ Organizing\ Committee$   $Piotr\ Ostrowski - Secretary$ 

#### Scientific Committee

#### Stanisław J. Matysiak - University of Warsaw - chairman

Jarosław Jędrysiak – Lodz University of Technology Andrzej Kaczyński – Warsaw University of Technology

Zbigniew Kołakowski – Lodz University of Technology

Piotr Konderla - Wroclaw University of Technology

Michał Kuciej - Białystok University of Technology

Mieczysław Kuczma – Poznan University of Technology

Izabela Lubowiecka – Gdansk University of Technology Radosław J. Mania - Lodz University of Technology

Bohdan Michalak – Lodz University of Technology

Wiesław Nagórko – Warsaw University of Life Sciences

Dorota Pawlus - University of Bielsko-Biala Andrzej Seweryn – Białystok University of Technology

Tomasz Stręk – Poznan University of Technology

Heorhiy Sulym - Bialystok University of Technology

Paweł Śniady – Wrocław University of Environmental and Life Sciences

Romuald Świtka – State School of Higher Vocational Education in Leszno

Barbara Tomczyk – Lodz University of Technology

Monika Wągrowska – Warsaw University of Life Sciences

Ewaryst Wierzbicki - Warsaw University of Life Sciences

Aleksander Yevtushenko – Bialystok University of Technology

#### ORGANIZING COMMITTEE

Lodz University of Technology The Faculty of Civil Engineering, Architecture and Environmental Engineering, Department of Structural Mechanics

Barbara Tomczyk - Chairman Piotr Ostrowski – Secretary

Łukasz Domagalski

Jarosław Jędrysiak

Szymon Langier

Jakub Marczak

Ewelina Pazera

Alina Radzikowska

Artur Wirowski