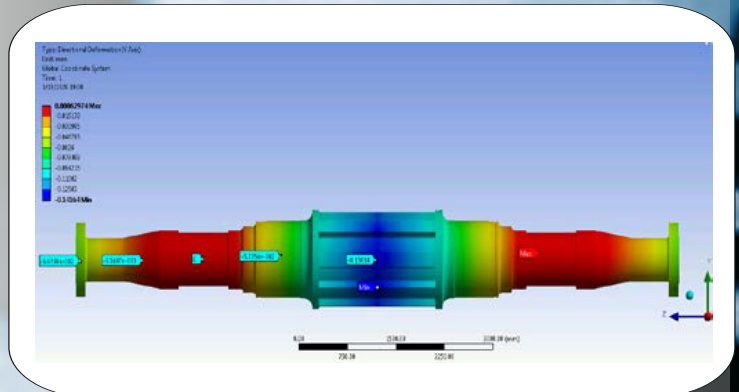


International journal  
for science, technics and  
innovations for the industry



**MACHINES**  
**TECHNOLOGIES**  
**MATERIALS**

**YEAR XV**    **Issue 8 / 2021**    **ISSN PRINT 1313-0226**  
**ISSN WEB 1314-507X**



Published by  
Scientific technical  
**Union of Mechanical Engineering**



# MACHINES. TECHNOLOGIES. MATERIALS

INTERNATIONAL SCIENTIFIC JOURNAL

ISSN PRINT 1313-0226, ISSN WEB 1314-507X, YEAR XV, ISSUE 8 / 2021

## INTERNATIONAL EDITORIAL BOARD

### EDITOR IN CHIEF:

**Georgi Popov**

Technical University of Sofia

BG

### MEMBERS:

Abdrakhman Naizabekov

Rudny industrial institute

KZ

Ahmet H. Ertas

Bursa Technical University

TR

Albert Albers

Karlsruhe Institut of Technology

DE

Andrzej Golabczak

Lodz University of Technology

PL

Andrzej Huczko

Warsaw University

PL

Dimitar Karaivanov

University of Chemical Technology and Metallurgy, Sofia

BG

Emilia Abadjieva

Akita University

JP

Erdem Camurlu

Akdeniz University, Antalya

TR

Eugen Sheregii

University of Rzeszow

PL

Franz Haas

Graz University of Technology

AT

Galina Nicolcheva

Technical University of Sofia

BG

Gennadii Bagliuk

Institute for Problems of Materials Science NAS of Ukraine, Kiev

UA

Georgii Raab

Ufa State Aviation Technical University

RU

Gregory Gurevich

Shamoon College of Engineering, Ashdod

IL

Hiroyuki Moriyama

Tokai University, Hiratsuka

JP

Idilia Batchkova

University of Chemical Technology and Metallurgy, Sofia

BG

Ivan Kralov

Technical University of Sofia

BG

Ivan Kuric

University of Zilina

SK

Julieta Kaleicheva

Technical University of Sofia

BG

Katia Vutova

Institute of Electronics, Bulgarian Academy of Sciences

BG

Maria Nikolova

Angel Kanchev University of Ruse

BG

Natasa Naprstkova

Jan Evangelista Purkyne University in Usti nad Labem

CZ

Oana Dodun

Gheorghe Asachi Technical University of Iasi

RO

Ognyan Andreev

Technical University of Sofia

BG

Predrag Dasic

High Technical Mechanical School of Trstenik

RS

Rasa Kandrotaitė

Kaunas University of Technology

LT

Raul Turmanidze

Georgian Technical University, Tbilisi

GE

Roumen Petrov

Ghent University

BE

Sergey Dobatkin

National University of Science and Technology "MISIS", Moscow

RU

Souren Mitra

Jadavpur University, Kolkata

IN

Svetlana Gubenko

National Metallurgical Academy of Ukraine, Dnipro

UA

Vedran Mrzljak

University of Rijeka

HR

Wu Kaiming

Wuhan University of Science and Technology

CN

### TECHNICAL EDITORS:

M. Sc. Eng. Radoslav Daskalov, M. Sc. Eng. Oleg Mihailov

Scientific and technical union of mechanical engineering  
108 R. S. Rakovski str., Sofia, Bulgaria  
[www.stumejournals.com](http://www.stumejournals.com), [office@stumejournals.com](mailto:office@stumejournals.com)

# CONTENTS

## MACHINES

<b>EGR operated engines process water equipment operational safety procedure</b> Delyan Hristov .....	291
<b>Analytical and numerical analysis of shafts' stress and strain states of the hydro-power unit</b> Ćulafić Stefan, Bajić Darko .....	294

## TECHNOLOGIES

<b>Kinetic and equilibrium study of the CO<sub>2</sub> adsorption on activated carbon</b> Bartosz Dziejarski, Anna Kisiela-Czajka .....	299
<b>Biosensor based on directly immobilized hemoglobin and myoglobin</b> Georgi Dyankov, Hristo Kisov, Evdokia Belina, Alexander Gisbrecht .....	303
<b>Dynamic mesh adaption in shockwaves simulations</b> Krzysztof Ewertowski, Krzysztof Czajka .....	306

## MATERIALS

<b>Ultrafine-grained structure and thermal stability of the two-phase titanium alloy vt8m-1</b> G. S. Dyakonov, O.B. Kulyasova, T. V. Yakovleva, A. G. Stotskiy .....	309
<b>The methodology of functional modifiers choice for nanocomposites based on industrial thermoplastics</b> Avdeychik Sergey .....	311
<b>Investigation of the coalescence of twin coplanar semi-elliptical fatigue cracks in structural steel elements under cyclic loading</b> Ivan Pidgurskyi, Mykola Stashkiv, Mykola Pidgurskyi .....	316
<b>Decreasing pressure losses by applying drilling mud with nanoparticles</b> Petar Mijić, Igor Medved, Sven Mijić .....	319
<b>Impact of chemical composition on tribological properties of Al<sub>x</sub>CoCrFeNi high-entropy alloys</b> Marzena Tokarewicz, Małgorzata Grądzka-Dahlke, Maciej Wróbel .....	323
<b>Operational characteristics of nanocomposite lubricants</b> Yauheni Auchynnikau .....	325
<b>Morphological study of rubber granules used in artificial turf systems with SEM and DSC methods</b> Kreshnik Hakrama, Genti Guxho .....	328
<b>Influence of the rate of cooling on the formation of non-equilibrium eutectics in pre-eutectic alloys of the AL-SI system</b> Donii O., Khristenko V., Kotliar S., Narizhna T. ....	331