



ISSN 2247-8604
ISSN-L 1454-9166

ANNALS
OF THE UNIVERSITY OF PETROSANI
MECHANICAL ENGINEERING
VOL. 27 (LIV)

UNIVERSITAS Publishing
PETROŞANI – ROMANIA
2025

ISSN 2247-8604, ISSN-L 1454-9166

EDITOR OF PUBLICATION
Prof. PhD. Eng. Sorin Mihai RADU

ADVISORY BOARD:

Prof.Eng. Moise-Ioan ACHIM Ph.D. – “1 Decembrie 1918” University of Alba-Iulia, *Romania*;

Prof.Eng. Iosif ANDRAŞ Ph.D. – University of Petroşani, *Romania*;

Prof.Eng. Alexandru BOROIU Ph.D. – University of Piteşti, *Romania*;

Prof.Eng. Anca BUCUREŞTEANU Ph.D. – “Politehnica” University of Bucureşti, *Romania*;

Prof.Eng. Ioan CARTIŞ Ph.D. – Politecnical University of Timişoara, *Romania*;

Prof.Eng. Ion CIUCĂ Ph.D. – “Politehnica” University of Bucureşti, *Romania*;

Prof.Eng. Predrag DAŠIĆ Ph.D. – High Technical Mechanical School R. Krstića, Trstenik, *Serbia*;

Prof.Eng. Netai Chandra DEY Ph.D. – Indian Institute of Engineering Science and Technology, *India*;

Assoc. Prof.Eng. Ákos Elemér DEBRECZENI Ph.D – University of Miskolc, *Hungary*;

Prof.Eng. Sorin DIMITRIU Ph.D. – “Politehnica” University of Bucureşti, *Romania*;

Prof.Eng. Valeriu DULGHERU Ph.D. – Tech. University of Moldova, Chişinău, *Republic of Moldova*;

Prof.Eng. Dan Ovidiu GLĂVAN Ph.D. – “Aurel Vlaicu” University of Arad, *Romania*;

Prof.Eng. António GONÇALVES–COELHO Ph.D. – Universidade Nova de Lisboa, *Portugal*;

Prof.Eng. Otto GRIGOROV Ph.D. – National Technical University of Kharkov, *Ukraine*;

Prof.Eng. Anatoli GHRABCHENKO Ph.D. – National Technical University of Kharkov, *Ukraine*;

Prof.Eng. Nicolae ILIAŞ Ph.D. – University of Petroşani, *Romania*;

Prof.Eng. Krzysztof KRAUZE Ph.D – AGH University of Science and Technology, *Poland*;

Prof.Eng. Traian MAZILU Ph.D. – “Politehnica” University of Bucureşti, *Romania*;

Prof.Eng. Mihai MINESCU Ph.D. – “Petroleum–Gas” University of Ploieşti, *Romania*;

Prof.Eng. Mircea NICOARĂ Ph.D. – Politehnica University of Timişoara, *Romania*;

Assoc. Prof.Eng. Damian PIETRUSIAK Ph.D. – Wroclaw University of Technology, *Poland*;

Prof.Eng. Gyula PATKO Ph.D – University of Miskolc, *Hungary*;

Prof.Eng. Cristina PUPĂZĂ – “Politehnica” University of Bucureşti, *Romania*;

Assoc. Prof.Eng. Eugen PĂMÎNTAŞ Ph.D. – Politecnical University of Timişoara, *Romania*;

Prof.Eng. Şerban RAICU Ph.D. – “Politehnica” University of Bucureşti, *Romania*;

Prof.Eng. Tomasz ROKITA Ph.D. – AGH University of Science and Technology, *Poland*;

Prof.Eng. Alexei TOCA Ph.D. – Technical University of Moldova, Chişinău, *Republic of Moldova*;

Prof.Eng. Raul R. TURMANIDZE Ph.D. – Technical University of Tbilisi, *Georgia*;

Prof.Eng. Nicolae UNGUREANU Ph.D. – Technical University of Cluj–Napoca, *Romania*;

Prof.Eng. Ioan VIDA–SIMITI Ph.D. – Technical University of Cluj–Napoca, *Romania*;

Assoc. Prof.Eng. Zoltán VIRÁG Ph.D – University of Miskolc, *Hungary*;

EDITORIAL BOARD:

Editor-in-chief: Prof.Eng.Habil. Florin Dumitru POPESCU Ph.D. - University of Petroşani, *Romania*
Deputy Editor: Prof.Eng.Habil. Andrei ANDRAŞ Ph.D. - University of Petroşani, *Romania*
Associate Editors: Prof.Eng.Habil. Dan Codruț PETRILEAN Ph.D. - University of Petroşani, *Romania*
Assoc.Prof.Eng. Bogdan-Zeno COZMA Ph.D. - University of Petroşani, *Romania*
Assoc.Prof.Eng. Sorin MIHĂILESCU Ph.D. - University of Petroşani, *Romania*
Assoc.Prof.Eng. Gabriel PAPORGESCU Ph.D. - University of Petroşani, *Romania*

Editorial office address:

University of Petroşani, 20 University Street, 332006, Petroşani, Romania,
Phone: (40) 254/54.29.94, 54.25.80, 54.25.81, 54.25.82, **Fax.** (40)254/54.34.91, 54.62.38,
<https://www.upet.ro/annals/mechanical/> E-mail: annals-mech@upet.ro | andrei.andras@gmail.com

Contents

Andraș, A., Codău, M.-V., Nicola, A.H. <i>Combined Theoretical and Experimental Analysis of Mechanical Rock Salt Cutting and Cutting Tool Characteristics</i>	1
Apostu, S.E., Șoica, A., Pupăză, C. <i>Optimizing Energy Efficiency in Industrial Installations: Comparison Between Conventional Methods and Additive Technologies</i>	9
Bogye, A., Petrilean, D.C. <i>Modular Gravity-Energy Storage Systems for Post-Mining Regeneration: A Technical and Symbolic Approach for the Jiu Valley</i>	19
Brînaș, I. <i>Study of the Structural Behaviour and Stability of Drill Strings</i>	27
Cozma, B.-Z. <i>Design of Wide Cable Binding Devices for Balancing Extraction Vessels</i>	41
Dinescu, S., Vilceanu, F. <i>Evaluation of the Structural Behavior of Front-End Loader Buckets Subjected to Digging Force Loads, Using the Finite Element Method</i>	49
Farhan, M. <i>Differentially Driven Wheeled Robot Constructed Using Lego Mindstorms Components</i>	61
Florea, V.A. <i>Reliability of Technological Flows. A Case Study</i>	73
Florea, V.A., Praporgescu, G. <i>The Behavior Analysis Results in Operating the Scraper Conveyors TR-3</i>	81
Itu, R.B., Șoica, A., Marc, B.-I. <i>Applications of Lamy's Theorem to Coplanar Concurrent Forces in Statics</i>	91
Itu, R.B., Vilceanu, F., Urdea, G.B. <i>Graphic and Analytical Determination of the Center of Mass of a Homogeneous L-Shaped Plate</i>	101
Malina, V.D., Andraș, A. <i>Critical Minerals in the Context of the Energy, Green and Digital Transition: Implications for Sustainable Development and Applied Research</i>	111

Mihăilescu, S. <i>Gini Index as a Measure of Passenger Traffic Concentration on the Bucharest Subway</i>	117
Mihăilescu, S. <i>Analysis of the Travel Modes of the Residents of the City of Petrosani</i>	131
Mija, N., Petrelean D.C. <i>Interactive Modeling and Simulation of the Otto Thermodynamic Cycle</i>	141
Moraru, R.I. <i>Modeling Safety Interventions in Maintenance Operations</i>	149
Moraru, R.I. <i>Optimizing Risk Assessment: The Center Point to Increase Maintenance Worker Safety</i>	159
Popescu, F.D., Brânaș, I., Brânaș, C.L. <i>Motion Analysis and Technological Volume Evaluation of a Hydraulic Excavator</i>	173
Popescu, F.D., Andraș, A., Brânaș, A.-K. <i>Dynamic Analysis of a Road Vehicle Using Numerical Methods and Multibody Simulation Techniques</i>	189
Pupăză, C., Șoica, A., Apostu, S.E., Tomescu, M.A. <i>Understanding the Investment Casting Process for Metal Parts and Cast Components</i>	197
Radu, S.M., Gane (Szegedi), O., Nicola, A.H. <i>Gravitational Energy Storage by Repurposing the Infrastructure of Decommissioned Underground and Open-Pit Mines</i>	205
Șoica, A., Pupăză, C., Apostu, S.E. <i>Evaluation of the Vibrational Behavior of a Mining Installation Using the Finite Element Method</i>	211
Vîlceanu, F., Dinescu, S. <i>Advanced Stress Analysis and Interpretation of the Bulldozer Blade Using Abaqus and Python Scripts</i>	219
Zamora, A., Stănilă, S.D. <i>Quality Management of Modern Mechanical Systems: Trends and Challenges</i>	237
Index of Authors	251
Instructions for Authors	253

INDEX OF AUTHORS

A		M	
Andraș, A.,	1, 111, 189	Malina, V.D.,	111
Apostu, S.E.,	9, 197, 211	Marc, B.I.,	91
		Mihăilescu, S.,	117, 131
B		N	
Bogye, A.	19	Mija, N.,	141
Brînaș, A.-K.,	189	Moraru, R.I.,	149, 159
Brînaș, C.L.,	173		
Brînaș, I.,	27, 173	Nicola, A.H.,	1, 205
C		P	
Codău, M.-V.,	1	Petrilean, D.C.,	19, 141
Cozma, B.-Z.,	41	Popescu, F.D.,	173, 189
D		Pupăză, C.,	9, 197, 211
Dinescu, S.,	49, 219	Praporgescu, G.,	81
F		R	
Farhan, M.,	61	Radu, S.M.,	205
Florea, V.A.,	73, 81		
G		S	
Gane (Szegedi), O.,	205	Stănilă, S.D.,	237
I		Ş	
Itu, R.B.	91, 101	Soica, A.,	9, 91, 197, 211

T		V	
Tomescu, M.A.,	197	Vîlceanu, F.	49, 101, 219
U		Z	
Urdea, G.B.	101	Zamora, A.,	237

INSTRUCTIONS FOR AUTHORS¹

THE TITLE OF THE PAPER WILL BE WRITTEN WITH CAPITAL LETTERS, CENTERED, AT 7.0 cm FROM THE UPPER EDGE OF A4 FORMAT, ALONG THE ENTIRE WIDTH, TIMES NEW ROMAN, 14 POINTS, BOLD.

- (14 points)
- (14 points)

The first name and family name will be written with CAPITALS, BOLD, CENTERED, 130 mm width, Times New Roman, 12 points, each name being followed by number, and in the footnote the didactic and scientific degree, position, affiliation, E-mail are indicated, with italics, 130 mm width, Times New Roman, 11 points.

- (12 points)
- (12 points)

<Tab> Abstract: (Times New Roman, 10 points, bold) The Abstract will only be in English and will have between 50 and 100 words, arranged all over the entire width, single, left – right alignment, all over the width of the printed space, Times New Roman, 10 points.

- (10 points)
- (10 points)

<Tab> Keywords: (Times New Roman, 10 points, bold) 5 – 10 words, in English, along the entire width, Times New Roman, 10 points.

- (10 points)
- (10 points)
- (10 points)

<Tab> 1. THE TITLE OF THE CHAPTER IS WRITTEN WITH CAPITAL LETTERS, BOLD, TIMES NEW ROMAN, 11 POINTS AND WILL BE NUMBERED WITH ARABIC NUMBERS.

- (11 points)

<Tab> The paper text paragraphs will be left – right aligned. The lines of the entire text will be single spaced with Times New Roman fonts, size 11 points.

The paper will be edited in a language of international circulation (English, French, German) on A4 format (210 x 297), page setup: top 5.6 cm, bottom 4.6 cm, left 3.7 cm, right 3.7 cm, in WORD and the number of pages must be even between 4 and 16. The size of the symbol is given next and is written in the instructions used to assist in editing the text. It indicates a blank line and does not show in the text of the paper, being obtained by pressing <ENTER>. The size of a <Tab> is 1.27 cm. No blank line is left between the paragraphs. Between the last line before the title and the title of the chapter and between the title and the first next line a blank line is left for each.

¹ Professor Eng., Ph.D. at the University of Petroșani, email address

<Tab> **1.1 Subchapter. Subchapters can be used in the text, numbered with the number of the chapter and a number showing the number of the subtitle within the chapter. The subchapters and the numbers are Times New Roman, 11 points, bold.**

(11 points)

The text is written in new paragraph and not continuing the subtitle, an 11 point blank line being left between the subtitle and the following text.

(11 points)

2. PRESENTATION OF THE FIGURES

(11 points)

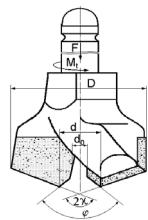


Fig. 1. Detachable bit

Figures should be enclosed in the text (if smaller) or placed on a separate line (if larger), in the order of their presentation, as close as possible on the page where reference is made to them. They shall be numbered with Arabic numbers. Black – and – white, high contrast figures are recommended. Photos can be used as well, but they should be of good quality, clarity and sufficient contrast. The figures will have a legend (name of the figure), which, along with the number, will be written underneath with Times New Roman, 10 points, centered as to the figure. The figures will be surrounded by text.

(11 points)

3. PRESENTATION OF THE TABLES

(11 points)

The tables will be enclosed in the text, a 10 points blank line being left above and under the table, and will be numbered with Arabic numbers. Both the number and the explanations to the table are written with Times New Roman, 10 points, italic, for the number and bold for the explanation to the table, centered in the space of the table and above it. The table entries will be Times New Roman, 10 points, bold, and the data in the table will be Times New Roman, 10 points. The thin lines of the table will be $\frac{1}{2}$ points (0.02 cm), and the thick ones will be $\frac{3}{4} \dots 1$ points (0.03 ... 0.04 cm).

(11 points)

4. PRESENTATION OF THE MATHEMATICAL EQUATIONS

(11 points)

The mathematical equations will be with times New Roman, 11 points, center of the page and numbered on the right with Arabic numbers between round brackets.

(8 points) <Blank line 8 point high>

$$X^2 + Y^2 = Z^2 \quad (1)$$

(8 points) < Blank line 8 point high>

An 8 point high blank line is left between the last line before the relation and the relation and between the latter and the next first line.

The last page will be at least 2/3 full.

The pages of the paper will only be numbered by a pencil outside the printing space.

(11 points)

REFERENCES (will be written according to the model, Times New Roman 10 points).

(10 points)

[1]. Marian I., *Mining mechanization*, Technical Publishing House, Bucharest, 1969 (Romanian language)