

**The 14<sup>th</sup> International Conference on  
Development and Application Systems  
DAS 2018**

**May 24-26, 2018  
Suceava - Romania**

**[www.dasconference.ro](http://www.dasconference.ro)**

# **Conference Program**

Organized by

**Stefan cel Mare University of Suceava  
Faculty of Electrical Engineering  
and Computer Science**

With technical sponsorship from

**IEEE Industry Applications Society  
Romania Section  
IEEE Conference Record #42809**



The 14<sup>th</sup> International Conference on **Development and Application Systems (DAS)**, organized biennially by *the Faculty of Electrical Engineering and Computer Science, Stefan cel Mare University of Suceava*, has four sections:

**A - Systems, Process Control and Automation**

**B - Communications and Computer Networks**

**C - Electronics and Computer Aided Engineering**

**D - Software Engineering and Information Technologies**

The scope of the Conference is to bring together specialists from universities, research institutes and companies for useful ideas exchanges regarding concerns in their domains. The latest progresses in these fields, as well as the newest scientific and technical results, will be presented and discussed during the Conference.

Participant registration will take place at Registration Desk at USV, Building E, on May 23 between 4:00 PM and 8:00 PM and on May 24, between 8:00 AM and 11:30 AM.

#### CONTACT INFORMATION

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## Thursday - May 24, 2018 – Day Summary

**09:00 - 09:10**    **Opening Ceremony**

*USV, Building E, Aula*

**09:10 - 11:10**    **Plenary Session 1**

*USV, Building E, Aula*

**11:10 - 12:00**    **Coffee break**

*USV, Building E, Aula*

**12:00 - 18:45**    **Technical Session Track 1**

*Details about paper presentation schedule for  
Section A and Section B on pages 11 and 14  
respectively*

**12:00 - 19:00**    **Technical Session Track 2**

*Details about paper presentation schedule for  
Section C and Section D on pages 16 and 18  
respectively*

**14:00 - 15:30**    **Lunch break**

*Restaurant Vivendi - @RestaurantVivendi*

**17:30 - 17:45**    **Coffee break**

*USV, Building E, Aula*

**19:30 - 23:00**    **Cocktail Party**

*Conacul Domnesc Restaurant - @ConaculDomnesc*

## Friday - May 25, 2018 – Day Summary

**10:00 - 12:00** Plenary Session 2

*USV, Building E, Aula*

**12:00 - 12:30** Coffee break

*USV, Building E, Aula*

**12:30 - 14:00** Round Table

*USV, Building E, Aula – Technology Education in the  
21st Century*

**14:00 - 15:30** Lunch break

*Restaurant Vivendi - @RestaurantVivendi*

**15:00 - 16:00** H&S 2018 Public Presentations

*USV, Building E, Atrium*

**17:00 - 17:30** H&S 2018 Award Ceremony

*USV, Building E, Atrium*

**18:00 - 18:30** Departure to Gura Humorului

*USV, Parking lot of Building A*

**20:00 - 23:00** Official Dinner

*Hotel Best Western Gura Humorului - @bwbucovina*

## **Saturday - May 26, 2018 – Day Summary**

**09:00 - 10:00 Breakfast**

*Hotel Best Western Gura Humorului - @bwbcovina*

**10:00 - 14:00 Monasteries Tour**

*Gura Humorului / Voronet / Free time*

**14:00 - 17:00 Traditional Lunch**

*Hotel Toaca Belvue - @hoteltoacabelvue*

**17:15 - 18:30 Departure to Suceava**

**Thursday - May 24, 2018**

**09:00 - 09:10    Opening Ceremony**

*USV, Building E, Aula*

*Welcome message addressed by*

**Adrian GRAUR**

DAS 2018 Conference Chair

**Mihai DIMIAN**

Vice-Rector of Stefan cel Mare University of Suceava

**09:10 - 11:10    Plenary Session 1**

*USV, Building E, Aula*

**Keynote Address -----**

*Instrumentation of Transmission line Towers for Real-Time Conditions Monitoring*

**Nathan IDA**

IEEE Fellow

Department of Electrical and Computer Engineering  
The University of Akron, USA

**Keynote Address -----**

*Smart Software as Future Challenge*

**Detlef STREITFERDT**

Ilmenau University of Technology, Software  
Architectures and Product Lines Group, Ilmenau,  
GERMANY

**Keynote Address -----**

*Extracting Knowledge from Electrical Demand Data*

**Gianfranco CHICCO**

IEEE Fellow

Galileo Ferraris Department of Energy, Politecnico di  
Torino, ITALY

**11:10 - 12:00 Coffee break**

*USV, Building E, Aula*

**12:00 - 18:15 Technical Session Track 1**

*Details about Section A and Section B on pages 8  
and 15 respectively*

**12:00 - 18:45 Technical Session Track 2**

*Details about Section C and Section D on pages 13  
and 18 respectively*

**14:00 - 15:30 Lunch break**

*Restaurant Vivendi - @RestaurantVivendi*

**17:30 - 17:45 Coffee break**

*USV, Building E, Aula*

**19:30 - 23:00 Cocktail Party**

*Conacul Domnesc Restaurant - @ConaculDomnesc*



**Friday - May 25, 2018**

**10:00 - 12:00 Plenary Session 2**

*USV, Building E, Aula*

**Keynote Address -----**

*Encoders for Simultaneous Sensing of Position and  
Speed - a Bottleneck in Electrical Drives with Digital  
Control*

**Ralph M. KENNEL**

IEEE Senior Member

Department of Electrical Engineering and Information  
Technology, Technical University of Munich,  
GERMANY

**Keynote Address -----**

*Modular Multilevel Converters - A New Technology*

**Remus TEODORESCU**

IEEE Fellow

Department of Energy Technology, Aalborg  
University, Aalborg, DENMARK

**Keynote Address -----**

*DC-DC Converters - Non-Conventional Topologies and  
Applications*

**Felix A. HIMMELSTOSS**

IEEE Fellow

Department of Energy and Industrial Electronics,  
University of Applied Sciences Technikum Wien,  
AUSTRIA

**12:00 - 12:30 Coffee break**

*USV, Building E, Aula*

**12:30 - 14:00 Round table**

*USV, Building D, Aula – "Technology Education in the 21st Century" Round Table*

**14:00 - 15:30 Lunch break**

*Restaurant Vivendi - @RestaurantVivendi*

**15:00 - 16:00 H&S 2018 Public Presentations**

*USV, Building E, Atrium*

**17:00 - 17:30 H&S 2018 Award Ceremony**

*USV, Building E, Atrium*

**18:00 - 18:30 Departure to Gura Humorului**

*USV, Parking lot of Building A*

*The transport from Suceava to Gura Humorului will be provided by the organizers. Accommodation for the 25.05 to 26.05 night, for all DAS 2018 participants, will be assured at Best Western Hotel in Gura Humorului, based on the participants' options in the Registration form.*

**20:00 - 23:00 Official Dinner**

*Hotel Best Western Gura Humorului - @bw bucovina*

**Thursday - May 24, 2018**

*Location: USV, Building E, Aula*

## **Technical Session Track 1**

**Section A: Systems, Process Control and Automation**

**12:00 - 16:45 Section A**

### **Session Co-Chairs**

**Gianfranco CHICCO**

*Politecnico di Torino, Italy*

**Cornel TURCU**

*Stefan cel Mare University of Suceava, Romania*

**Vasile Gheorghita GĂITAN**

*Stefan cel Mare University of Suceava, Romania*

**Radu Dumitru PENTIUC**

*Stefan cel Mare University of Suceava, Romania*

**Paper ID: A01 - 12:00 - 12:15**

*Additive Noise Removal using a Nonlinear Hyperbolic PDE-based Model*

Tudor BARBU

*Institute of Computer Science, Romanian Academy, Iasi*

**Paper ID: A07 - 12:15 - 12:30**

*Integration of Renewable Energy Sources using Generation Expansion Planning*

Catalina Alexandra SIMA<sup>1</sup>, George Cristian LAZAROIU<sup>1,2</sup>, Virgil DUMBRAVA<sup>1</sup>, Mihai TIRSU<sup>3</sup>, Victor GALBURA<sup>3</sup>

<sup>1</sup> Politehnica University of Bucharest, Romania

<sup>2</sup> Maritima University of Contanta, Romania

<sup>3</sup> Institute of Power Engineering, Academy of Sciences of Moldova, Moldova

**Paper ID: A13 - 12:30 - 12:45**

*m-GreenCARDIO Embedded System Designed for Out-of-Hospital Cardiac Patients*

Ionel ZAGAN<sup>1,2</sup>, Vasile Gheorghita GAITAN<sup>1,2</sup>, Nicolai IUGA<sup>1</sup>, Adrian BREZULIANU<sup>3</sup>

<sup>1</sup> Faculty of Electrical Engineering and Computer Science, Stefan cel Mare University, Suceava, Romania

<sup>2</sup> Integrated Center for Research, Development and Innovation in Advanced Materials, Nanotechnologies, and Distributed Systems

for Fabrication and Control (MANSiD), Stefan cel Mare University  
of Suceava, Romania

<sup>3</sup> Gheorghe Asachi Technical University of Iași, Romania

**Paper ID: A14 - 12:45 - 13:00**

*Synthesis Analysis and Evaluation of Hardware Scheduler  
based on Different Scheduling Algorithms*

Ionel ZAGAN<sup>1,2</sup>

<sup>1</sup> Faculty of Electrical Engineering and Computer Science, Stefan  
cel Mare University, Suceava, Romania

<sup>2</sup> Integrated Center for Research, Development and Innovation in  
Advanced Materials, Nanotechnologies, and Distributed Systems  
for Fabrication and Control (MANSiD), Stefan cel Mare University  
of Suceava, Romania

**Paper ID: A18 - 13:00 - 13:15**

*Modeling and Control of a Low Power Wind Turbine*

Dana-Alexandra CIUPAGEANU<sup>1</sup>, Gheorghe LAZAROIU<sup>1</sup>,  
Viorel BERBECE<sup>1</sup>, Mihai TIRSU<sup>2</sup>, Victor GALBURA<sup>2</sup>

<sup>1</sup> Politehnica University of Bucharest, Romania

<sup>2</sup> Institute of Power Engineering, Academy of Sciences of Moldova,  
Moldova

**Paper ID: A19 - 13:15 - 13:30**

*Combining the MIT and Lyapunov Stability Adaptive  
Methods for Second Order Systems*

Simona COMAN, Cristian BOLDISOR, Costin CIUSDEL  
Transilvania University, Brasov, Romania

**Paper ID: A22 - 13:30 - 13:45**

*Microgrid Primary Control And Continuous-Time Operation*

Andrei HORHOIANU, Mircea EREMIA, Mihai SANDULEAC  
Politehnica University of Bucharest, Romania

**Paper ID: A24 - 13:45 - 14:00**

*Study of a System for Reducing Electricity Losses*

Mihai CENUSA, Mihaela POIENAR, Dan Laurențiu MILICI  
Stefan cel Mare University, Suceava, Romania

**// Lunch break 14:00 – 15:30**

**Paper ID: A26 - 15:30 - 15:45**

*The Experimental Method for Tuning of PID Controller  
Based on the Maximum Stability Degree Criterion*

Ion FIODOROV, Irina COJUHARI, Bartolomeu IZVOREANU,  
Dumitru MORARU, Sorin BOTNARU, Radu MELNIC  
Technical University of Moldova, Chisinau, Republic of Moldova

**Paper ID: A32 - 15:45 - 16:00**

*Multi-Agent Cognitive System for Optimal Solution Search*

Victor ABABII, Viorica SUDACEVSCHI, Silvia MUNTEANU,  
Dimitrie BORDIAN, Dmitri CALUGARI, Ana NISTIRIUC, Sergiu  
DILEVSCHI

Technical University of Moldova, Chisinau, Republic of Moldova

**Paper ID: A42 - 16:00 - 16:15**

*Design of Vertical Earth Grounding with Rectangular  
Outline by Minimizing its Total Metal Mass*

Virgil MAIER, Claudiu CIORCA, Sorin G. PAVEL and Horia G.  
BELEIU, Iulian BIROU

Technical University of Cluj-Napoca, Romania

**Paper ID: A44 - 16:15 - 16:30**

*Performance Analysis of Tasks Synchronization for Real  
Time Operating Systems*

Ioan UNGUREAN<sup>1,2</sup>, Nicoleta Cristina GAITAN<sup>1,2</sup>

<sup>1</sup> Faculty of Electrical Engineering and Computer Science, Stefan cel  
Mare University of Suceava

<sup>2</sup> Integrated Center for Research, Development and Innovation in  
Advanced Materials, Nanotechnologies, and Distributed Systems  
for Fabrication and Control (MANSiD) Suceava, Romania

**Paper ID: A49 - 16:30 - 16:45**

*Practical and Low-cost Solution for the Temperature Control of  
a Substrate Heater for Thin Film Deposition*

Albert-Zsombor FEKETE, Laszlo JAKAB-FARKAS

Sapientia - Hungarian University of Transylvania, Tg. Mures, Romania

**// Coffee break 16:45 – 17:00**

**Thursday - May 24, 2018**

**Location: USV, Building E, Aula**

## **Technical Session Track 1**

**Section B: Communications and Computer Networks**

**17:00 - 18:15 Section B**

### **Session Co-Chairs**

**Remus TEODORESCU**

*Aalborg University, Denmark*

**Nicolae Dumitru ALEXANDRU**

*Gheorghe Asachi Technical University of Iasi, Romania*

**Alin Dan POTORAC**

*Stefan cel Mare University of Suceava, Romania*

**Paper ID: B04 - 17:00 - 17:15**

*LoRaWAN Communication Protocol: The New Era of IoT*

Alexandru LAVRIC<sup>1</sup>, Adrian Ioan PETRARIU<sup>1,2</sup>

<sup>1</sup>Stefan cel Mare University of Suceava, Romania

<sup>2</sup>Integrated Center for Research, Development and Innovation in Advanced Materials, Nanotechnologies and Distributed Systems for Fabrication and Control (MANSiD), Stefan cel Mare University of Suceava, Romania

**Paper ID: B17 - 17:15 - 17:30**

*Vehicular Cloud: Overview and Security Issues*

Lucian GAFENCU, Luminita SCRIPCARIU

*Gheorghe Asachi Technical University of Iasi, Romania*

**Paper ID: B21 - 17:30 - 17:45**

*An Analysis of Improved Nyquist Pulses Based on Pearson Distance*

Nicolae Dumitru ALEXANDRU<sup>1</sup>, Alexandra Ligia BALAN<sup>2</sup>

<sup>1</sup>Gheorghe Asachi Technical University of Iasi, Romania

<sup>2</sup>Integrated Center for Research, Development and Innovation in Advanced Materials, Nanotechnologies and Distributed Systems for Fabrication and Control (MANSiD), Stefan cel Mare University of Suceava, Romania

**Paper ID: B29 - 17:45 - 18:00**

*Bandwidth Management Application in a Directory Service Environment*

Marius C. BREABAN, Adrian GRAUR, Alin D. POTORAC, Doru G.  
BALAN

Integrated Center for Research, Development and Innovation in  
Advanced Materials, Nanotechnologies and Distributed Systems for  
Fabrication and Control (MANSiD), Stefan cel Mare University of  
Suceava, Romania

**Paper ID: B50 - 18:00 - 18:15**

*Vertical Polarized Antennas for Low-VHF Radio Meteor  
Detection*

Cezar-Eduard LESANU<sup>1</sup>, Adrian DONE<sup>2</sup>, Alin-Mihai CAILEAN<sup>1,2</sup>,  
Adrian GRAUR<sup>1,2</sup>

<sup>1</sup> Stefan cel Mare University of Suceava, Romania

<sup>2</sup> Integrated Center for Research, Development and Innovation in  
Advanced Materials, Nanotechnologies and Distributed Systems for  
Fabrication and Control (MANSiD), Stefan cel Mare University of  
Suceava, Romania

Thursday - May 24, 2018

*Location: USV, Building D, E005*

## Technical Session Track 2

Section C: Electronics and Computer Aided Engineering

**12:00 - 13:45 Section C**

### *Session Co-Chairs*

**Nathan IDA**

University of Akron, USA

**Eugen COCA**

*Stefan cel Mare University of Suceava, Romania*

**Adrian PETRARIU**

*Stefan cel Mare University of Suceava, Romania*

**Paper ID: C10 - 12:00 - 12:15**

*System for Monitoring of Hot Spot Temperature of Power Transformer Windings Using Fiber Optic Sensors, Kalman Filter and SCADA Integration*

Marcel NICOLA, Claudiu-Ionel NICOLA, Marian DUTA,  
Dumitru SACERDOTIANU, Iulian HUREZEANU

National Institute for Research, Development and Testing in  
Electrical Engineering - ICMET Craiova, Romania

**Paper ID: C25 - 12:15 - 12:30**

*Stand for Investigating the Measuring Methodical Errors of  
Microcontrollers Average Energy Power Consumption*

Oleksandr OSOLINSKYI<sup>1</sup>, Volodymyr KOCHAN<sup>1</sup>, Grygoriy  
SAPOZHNYK<sup>1</sup>, Anatoliy SACHENKO<sup>2</sup>

<sup>1</sup>Ternopil National Economic University, Ternopil, Ukraine

<sup>2</sup>Kazimierz Pulaski University of Technology and Humanities in  
Radom, Poland

**Paper ID: C27 - 12:30 - 12:45**

*Porous spinel-type oxide semiconductors for high-  
performance acetone sensors*

Corneliu DOROFTEI<sup>1</sup>, Otilia Sanda PRELIPCEANU<sup>1</sup>, Aurelian  
CARLESCU<sup>1</sup>, Liviu LEONTIE<sup>1</sup>, Marius PRELIPCEANU<sup>2</sup>

<sup>1</sup>Integrated Center of Environmental Science Studies in the

Northeast Region (CERNESIM), Alexandru Ioan Cuza University,  
Iasi, Romania



<sup>2</sup> Integrated Center for Research, Development and Innovation in Advanced Materials, Nanotechnologies and Distributed Systems for Fabrication and Control (MANSiD), Stefan cel Mare University of Suceava, Romania

**Paper ID: C36 - 12:45 - 13:00**

*Green power supply for an intelligent traffic light enhanced with visible light communications capabilities*

Adrian DONE<sup>1,2</sup>, Elena-Daniela OLARIU<sup>1,2</sup>, Alin-Mihai CAILEAN<sup>1,2</sup>, Sebastian-Andrei AVATAMANITEI<sup>1,2</sup>

<sup>1</sup> Integrated Center for Research, Development and Innovation in Advanced Materials, Nanotechnologies and Distributed Systems for Fabrication and Control (MANSiD), Stefan cel Mare University of Suceava, Romania

<sup>2</sup> Stefan cel Mare University of Suceava, Romania

**Paper ID: C40 - 13:00 - 13:15**

*Harmonic Compensation with Active Loads Designed for Power Quality Improvement in Microgrids*

Ioan SERBAN

Transilvania University, Brasov, Romania

**Paper ID: C43 - 13:15 – 13:30**

*An Evaluation of an Ultra-High Frequency Electromagnetic Fields Energy and Recovery Solutions*

Aurel CHIRAP, Eugen COCA, Dan Alin POTORAC

Stefan cel Mare University of Suceava, Romania

**Paper ID: C53 - 13:30 - 13:45**

*VLC for Vehicular Communications: A Multiple Input Multiple Output (MIMO) Approach*

Adrian Ioan PETRARIU<sup>1,2</sup>, Alexandru LAVRIC<sup>1</sup>, Eugen COCA<sup>1</sup>

<sup>1</sup> Stefan cel Mare University of Suceava, Romania

<sup>2</sup> Integrated Center for Research, Development and Innovation in Advanced Materials, Nanotechnologies and Distributed Systems for Fabrication and Control (MANSiD), Stefan cel Mare University of Suceava, Romania

**// Lunch break 14:00 – 15:30**

**Thursday - May 24, 2018**

**Location: USV, Building D, E005**

## **Technical Session Track 2**

**Section D: Software Engineering and Information  
Technologies**

**15:30 - 18:45 Section D**

### **Session Co-Chairs**

**Detlef STREITFERDT**

*Ilmenau University of Technology, Germany*

**Cristina Elena TURCU**

*STEFAN cel Mare University of Suceava, Romania*

**Stefan Gheorghe PENTIUC**

*Stefan cel Mare University of Suceava, Romania*

**Radu Daniel VATAVU**

*Stefan cel Mare University of Suceava, Romania*

**Paper ID: D03 - 15:30 - 15:45**

*Detection the Mid-Sagittal Plane in Brain Slice MR Images by  
Using Local Ternary Pattern*

Faiq BAJI, Mihai MOCANU, Didi POPA

*University of Craiova, Romania*

**Paper ID: D12 - 15:45 - 16:00**

*Drive Me: a Interaction System Between Human and Robot*

Stefan-Gheorghe PENTIUC, Oana-Mihaela VULTUR

*Stefan cel Mare of University Suceava, Romania*

**Paper ID: D15 - 16:00 - 16:15**

*VERGE: A System for Collecting Voice, Eye Gaze, Gesture, and  
EEG Data for Experimental Studies*

Ovidiu GHERMAN, Ovidiu SCHIPOR, Bogdan-Florin GHERAN

MintViz Lab | MANSiD Research Center, Stefan cel Mare of University  
Suceava, Romania

**Paper ID: D28 - 16:15 - 16:30**

*Determining Neural Network Architecture Using Data Mining  
Techniques*

Mohamed Lafif TEJ, Stefan HOLBAN

*Politehnica University of Timisoara, Romania*

**Paper ID: D31 - 16:30 - 16:45**

*Discovering Electricity Consumption Over Time for Residential Consumers Through Cluster Analysis*

Tania CERQUITELLI<sup>1</sup>, Gianfranco CHICCO<sup>1</sup>, Evelina Di CORSO<sup>1</sup>,  
Francesco VENTURA<sup>1</sup>, Giuseppe MONTESANO<sup>2</sup>, Anita Del  
PIZZO<sup>2</sup>, Alicia Mateo GONZÁLEZ<sup>3</sup>, Eduardo Martin SOBRINO<sup>3</sup>

<sup>1</sup> Politecnico di Torino, Italy

<sup>2</sup> ENEL Foundation, Italy

<sup>3</sup> ENDESA Energia, Spain

**// Coffee break 16:45 – 17:00**

**Paper ID: D33 - 17:00 - 17:15**

*Security Assessment of OpenStack cloud using outside and  
inside software tools*

Ionel GORDIN, Adrian GRAUR, Dan Alin POTORAC, Doru  
BALAN

Stefan cel Mare University of Suceava, Romania

**Paper ID: D37 - 17:15 - 17:30**

*Enabling IoT connectivity for Modbus networks by using IoT  
edge gateways*

Ghenadie COROTINSCHI, Vasile Gheorghita GAITAN

Stefan cel Mare University of Suceava, Romania

**Paper ID: D38 - 17:30 - 17:45**

*Determining Optimal Neural Network Architecture Using  
Regression Methods*

Mohamed Lafif TEJ, Stefan HOLBAN

Politehnica University of Timisoara, Romania

**Paper ID: D41 - 17:45 - 18:00**

*Tube Center Detection in SEM Images of Titania Nanotube  
Arrays*

Adrian CIOBANU<sup>1</sup>, Mihaela LUCA<sup>1</sup>, Tudor BARBU<sup>1</sup>, Claudia  
Teodora TEODORESCU-SOARE<sup>2</sup>

<sup>1</sup> Institute of Computer Science, Romanian Academy, Iasi

<sup>2</sup> Alexandru Ioan Cuza University of Iasi, Romania

**Paper ID: D48 - 18:00 - 18:15**

*Automated Video Surveillance System based on Hierarchical  
Object Identification*

Diana ZAHORODNIA<sup>1</sup>, Yuriy PIGOVSKY<sup>1</sup>, Pavlo BYKOVYY<sup>1</sup>, Viktor  
KRYLOV<sup>1</sup>, Anatoliy SACHENKO<sup>2</sup>, Agnieszka MOLGA<sup>2</sup>

<sup>1</sup> Ternopil National Economic University, Ukraine

<sup>2</sup> Kazimierz Pulaski University of Technology and Humanities of  
Radom, Poland

**Paper ID: D51 - 18:15 - 18:30**

*One Pattern Recognition Method for Complex Geometric  
Clusters Configuration*

Valerii FRATAVCHAN, Tonia FRATAVCHAN

Yuriy Fedkovych Chernivtsi National University, Ukraine

**Paper ID: D52 - 18:30 - 18:45**

*Improving the Adaptive Neuro-Fuzzy Method to Intellectualize  
Multisensor Signals Processing*

Su JUN<sup>1</sup>, Nataliia ROSHCHUPKINA<sup>2</sup>, Oleksiy ROSHCHUPKIN<sup>2</sup>,  
Volodymyr KOCHAN<sup>3</sup>

<sup>1</sup>Hubei University of Technology, Wuhan, China

<sup>2</sup>Yuriy Fedkovych Chernivtsi National University, Ukraine

<sup>3</sup>Ternopil National Economic University, Ternopil, Ukraine







