TEKA

KOMISJI MOTORYZACJI
I ENERGETYKI ROLNICTWA
POLITECHNIKI LUBELSKIEJ
WSCHODNIOUKRAŃSKIEGO NARODOWEGO UNIWERSYTETU
IM. WOŁODYMYRA DALA W ŁUGAŃSKU

COMMISSION OF MOTORIZATION
AND POWER INDUSTRY IN AGRICULTURE
LUBLIN UNIVERSITY OF TECHNOLOGY
THE VOLODYMYR DAHL EAST-UKRAINIAN
NATIONAL UNIVERSITY OF ŁUGAŃSK
TEKA

KOMISJI MOTORYZACJI I ENERGETYKI ROLNICTWA
POLITECHNIKI LUBELSKIEJ
WSCHODNIOUKRAIŃSKIEGO NARODOWEGO UNIWERSYTETU
IM. WOŁODYMYRA DALA W ŁUGAŃSKU

Tom IX

LUBLIN 2009
TEKA

COMMISSION OF MOTORIZATION AND POWER INDUSTRY IN AGRICULTURE
LUBLIN UNIVERSITY OF TECHNOLOGY
THE VOLODYMIR DAHL EAST-UкраiNIAN NATIONAL UNIVERSITY OF ŁUGAŃSK

Volume IX

LUBLIN 2009
President of editorial and scientific committee

Eugentuz Krasowski

Secretary

Zbigniew Burski

Editorial committee

Scientific committee

Andrzej Ambrozik, Kielce, Poland
Volodymyr Bulgakov, Kiev, Ukraine
Kazimierz Dresser, Lublin, Poland
Bohdan Hvoiko, Termopol, Ukraine
Marek Idzior, Poznań, Poland
L.P.B.M. Jonsson, Groningen, Holland
Elżbieta Kasińska, Lublin, Poland
Józef Kowalczyk, Lublin, Polska
Stepan Kovalyshyn, Lwów, Ukraine
Nikolaj Lubomirski, Simferopol, Krym, Ukraine
Jerzy Merkisz, Poznań, Poland
Leszek Mońcicki, Lublin, Poland
Janusz Mycielski, Szczecin, Poland
Ilya Nikolenko, Simferopol, Ukraine
Stanislav Nizinski, Olszyin, Poland

Popel Nosko, Ługańsk, Ukraine
Janusz Nowak, Lublin, Poland
Sergiej Pastushenke, Kiev, Ukraine
Jan Sowa, Lublin, Poland
Ludvikas Spokas, Kaunas, Lithuania
Povilas A. Sirvydas, Kaunas, Lithuania
Stanislaw Sosnowski, Ropczyce, Poland
Alekandr Sydorchuk, Lwów, Ukraine
Georgiy Takanovskiy, Minsk, Belarus
Wojciech Tamaś, Lublin, Poland
Henrik Tylicki, Bydgoszcz, Poland
Danis Viesturs, Ulbrok, Latvia
Dmytro Voytuk, Kiev, Ukraine
Janusz Wójcik, Warszawa, Poland
Bogdan Zoltowski, Bydgoszcz, Poland

All the scientific articles received positive evaluations by independent reviewers

Linguistic consultant: Małgorzata Wojciechowska
Technical editor: Robert Kryński
Typeset: Robert Kryński, Hanna Krasowska Kołodziej
Cover design: Barbara Jarosik

© Copyright by Commission of Motorization and Power Industry in Agriculture
Polish Academy of Sciences Branch in Lublin, Lublin 2009
© Copyright by Lublin University of Technology

Commission of Motorization and Power Industry in Agriculture
Wielkopolska Str. 62, 20-725 Lublin, Poland
e-mail: cugentuz.krasowski@up.lublin.pl

ISSN 1641–7739
Edition 150 + 16 vol.

Drukarnia Flpil
08-110 Siedlce, ul. Artylerocka 11
PREFACE

Dear Editor-In-Chief, Prof. Eugeniusz Krasowski

On the occasion of the 9th Volume’s Edition of TEKA – an international scientific-technical magazine of the Polish Academy of Sciences – Branch in Lublin, The Lublin University of Technology and our University, I would like, on behalf of the professors and teachers of the East-Ukrainian Vladimir Dahl National University, to congratulate you on your valuable effort resulting in this competent and professional academic journal. I feel honoured to be invited to participate in the project.

The TEKA is a widely recognised and appreciated magazine enjoying a great popularity among academic communities, which is proved by the participation of numerous outstanding authors - famous East-Central European scientists. Also, I am pleased to notice the growing number of publications by professors from the Lugansk East-Ukrainian University. Publication in the TEKA of articles by outstanding international scientists makes the journal even more reliable and contributes to its high scientific value.

Science has always been considered as the most complicated and delicate sphere of human activity. I believe that only due to science it can be possible to solve all the problems facing mankind both now and in the future. But one must not forget the fact that all the discoveries and inventions of the scientists so far have not only been doing the good, but also the harm to all the human beings on the planet Earth. I am convinced that it is possible to stop this tendency only due to openness, reliability and accessibility to the broad public of all the results of research which is carried out worldwide. The best way of achieving this is their publication in scientific journals in which authors from different countries can share the details of scientific results and show their perspectives.

My best wishes of great success in your editing work reaching the widest possible international academic community of readers.

Yours sincerely

Professor Oleksandr Golubenko
Rector of the East-Ukrainian Vladimir Dahl National University