TEKA

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

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

POLSKA AKADEMIA NAUK ODDZIAŁ W LUBLINIE POLITECHNIKA LUBELSKA WSCHODNIOUKRAIŃSKI NARODOWY UNIWERSYTET IM. WOŁODYMYRA DALA W ŁUGAŃSKU

TEKA

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

Tom IX

POLISH ACADEMY OF SCIENCES BRANCH IN LUBLIN LUBLIN UNIVERSITY OF TECHNOLOGY THE VOLODYMIR DAHL EAST-UKRAINIAN NATIONAL UNIVERSITY OF ŁUGAŃSK

TEKA

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

Volume IX

President of editorial and scientific committee

Eugeniusz Krasowski

Secretary

Zbigniew Burski

Editorial committee

Andrzej Ambrozik, Jan Gliński, Karol Cupiał, Aleksandr Dashchenko, Sergiey Fedorkin, Oleksandr Hołubenko, Anatoliy Yakovenko, Henryk Komsta, Janusz Laskowski, Jerzy Merkisz, Ryszard Michalski, Aleksandr Morozow, Janusz Mysłowski, Ilya Nikolenko, Stanisław Niziński, Marek Opielak, Marek Rozmus, Ludvikas Shpokas, Wolodymyr Snitynskiy, Aleksandr Sydorchuk, Georgiy F. Tayanowski

Scientific committee

Andrzej Ambrozik, Kielce, Poland
Volodymyr Bulgakow, Kiev, Ukraine
Kazimierz Dreszer, Lublin, Poland
Bohdan Hevko, Termopil, Ukraine
Marek Idzior, Poznań, Poland
L.P.B.M. Jonssen, Groningen, Holland
Elżbieta Kusińska, Lublin, Poland
Józef Kowalczuk, Lublin, Polska
Stepan Kovalyshyn, Lwów, Ukraine
Nikolaj Lubomirski, Simferopol, Krym, Ukraine
Jerzy Merkisz, Poznań, Poland
Leszek Mościcki, Lublin, Poland
Janusz Mysłowski, Szczecin, Poland
Ilya Nikolenko, Simferopol, Ukraine
Stanisław Niziński, Olsztyn, Poland

Pawel Nosko, Ługańsk, Ukraine
Janusz Nowak, Lublin, Poland
Sergiey Pastushenko, Kiev, Ukraine
Jan Sawa, Lublin, Poland
Ludvikas Spokas, Kaunas, Lithuania
Povilas A. Sirvydas, Kaunas, Lithuania
Stanisław Sosnowski, Ropczyce, Poland
Aleksandr Sydorchuk, Lwów, Ukraine
Georgij Tayanowski, Mińsk, Belarus
Wojciech Tanaś, Lublin, Poland
Henryk Tylicki, Bydgoszcz, Poland
Danis Viesturs, Ulbrok, Latvia
Dmytro Voytiuk, Kiev, Ukraine
Janusz Wojdalski, Warszawa, Poland
Bogdan Żóltowski, Bydgoszcz, Poland

All the scientific articles received positive evaluations by independent reviewers

Linguistic consultant: Małgorzata Wojcieszuk 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: eugeniusz.krasowski@up.lublin.pl

> > ISSN 1641-7739

Edition 150 + 16 vol.

Drukarnia Elpil 08-110 Siedlce, ul. Artyleryjska 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 the 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