

THE SZEWALSKI INSTITUTE OF FLUID-FLOW MACHINERY
POLISH ACADEMY OF SCIENCES

TRANSACTIONS
OF THE INSTITUTE OF
FLUID-FLOW MACHINERY

115



GDAŃSK 2004

TRANSACTIONS OF THE INSTITUTE OF FLUID-FLOW MACHINERY

Appears since 1960

Aims and Scope

Transactions of the Institute of Fluid-Flow Machinery have primarily been established to publish papers from four disciplines represented at the Institute of Fluid-Flow Machinery of Polish Academy of Sciences, such as:

- Liquid flows in hydraulic machinery including exploitation problems,
- Gas and liquid flows with heat transport, particularly two-phase flows,
- Various aspects of development of plasma and laser engineering,
- Solid mechanics, machine mechanics including exploitation problems.

The periodical, where originally were published papers describing the research conducted at the Institute, has now appeared to be the place for publication of works by authors both from Poland and abroad. A traditional scope of topics has been preserved.

Only original and written in English works are published, which represent both theoretical and applied sciences. All papers are reviewed by two independent referees.

EDITORIAL COMMITTEE

Jarosław Mikieliewicz(Editor-in-Chief), Jan Kiciński, Edward Śliwicki
(Managing Editor)

EDITORIAL BOARD

Brunon Grochal, Jan Kiciński, Jarosław Mikieliewicz (Chairman), Jerzy Mizeraczyk, Wiesław Ostachowicz, Wojciech Pietraszkiewicz, Zenon Zakrzewski

INTERNATIONAL ADVISORY BOARD

M. P. Cartmell, *University of Glasgow, Glasgow, Scotland, UK*
G. P. Celata, *ENEA, Rome, Italy*
J.-S. Chang, *McMaster University, Hamilton, Canada*
L. Kullmann, *Technische Universität Budapest, Budapest, Hungary*
R. T. Lahey Jr., *Rensselaer Polytechnic Institute (RPI), Troy, USA*
A. Lichtarowicz, *Nottingham, UK*
H.-B. Matthias, *Technische Universität Wien, Wien, Austria*
U. Mueller, *Forschungszentrum Karlsruhe, Karlsruhe, Germany*
T. Ohkubo, *Oita University, Oita, Japan*
N. V. Sabotinov, *Institute of Solid State Physics, Sofia, Bulgaria*
V. E. Verijenko, *University of Natal, Durban, South Africa*
D. Weichert, *Rhein.-Westf. Techn. Hochschule Aachen, Aachen, Germany*

EDITORIAL AND PUBLISHING OFFICE

IFFM Publishers (Wydawnictwo IMP), Institute of Fluid Flow Machinery, Fiszera 14, 80-952 Gdańsk, Poland, Tel.: +48(58)3411271 ext. 141, Fax: +48(58)3416144, E-mail: esli@imp.gda.pl <http://www.imp.gda.pl/>

© Copyright by Institute of Fluid-Flow Machinery, Polish Academy of Sciences, Gdańsk



Terms of subscription

Subscription order and payment should be directly sent to the Publishing Office

Warunki prenumeraty w Polsce

Wydawnictwo ukazuje się przeciętnie dwa lub trzy razy w roku. Cena numeru wynosi 20,- zł + 5,- zł koszty wysyłki. Zamówienia z określeniem okresu prenumeraty, nazwiskiem i adresem odbiorcy należy kierować bezpośrednio do Wydawcy (Wydawnictwo IMP, Instytut Maszyn Przepływowych PAN, ul. Gen. Fiszera 14, 80-952 Gdańsk). Osiągalne są również wydania poprzednie. Prenumerata jest również realizowana przez jednostki kolportażowe RUCH S.A. właściwe dla miejsca zamieszkania lub siedziby prenumeratora. W takim przypadku dostawa następuje w uzgodniony sposób.

ISSN 0079-3205

Editorial

We are glad to hand over the 115th volume of the *Transactions of IFFM* to our readers. We take this opportunity to inform you with great pleasure that the Editor-in-Chief of our periodical, Professor Jarosław Mikielwicz, has been awarded with the title of Doctor Honoris Causa from the Cracow University of Technology, in recognition of his merits in the field of thermodynamics and heat transfer. The Rector of Cracow University of Technology conveyed the distinction to Prof. Mikielwicz on May 14th, 2004 at a solemn session of the University Senate.



We would also like to join the large circle of his acquaintances and friends of the world of science wishing him much success in research work in the hope of further cooperation in popularizing scientific problems represented at the Sze-walski Institute of Fluid-Flow Machinery of the Polish Academy of Science.

Members of the Editorial Committee

J. Kiciński

E. Śliwicki

CONTENTS

Piotrowski A.: Numerical modelling of ventilation in blind headings in mines	5
Zapałowicz Z.: Effect of thermodynamic parameters of surrounding air on the dynamic wetting of surface by droplets	21
Kiciński J.: Coupled forms of non-linear vibrations as a new tool of crack detection in rotating shaft	37
Frączak J. W. and Burka E. S.: Simulation of incompressible flow past a bluff cylinder by means of a discrete vortex method	69
Adamkowski A. and Lewandowski M.: Unsteady friction modelling in transient pipe flow simulation	83
Iwan J.: Hydraulic turbine development for low-output power plants	99
Adamkowski A. and Kwapisz L.: Strength analysis of penstock bifurcations in hydropower plants	113
Korczak A. and Papierski A.: The flow through the face clearance of the disk relieving the axial force in multi-stage centrifugal pump	125