

International Editorial Advisory Board

Andrzej AMBROZIK	Tad JAROSZCZYK (USA)	Wojciech PRZETAKIEWICZ
Masutaka ARAI (Japan)	Jerzy JASKOLSKI	Stanislaw RADKOWSKI
Kazimierz BACZEWSKI	Jerzy JAZWINSKI	Marek REKSA
Rik BAERT (Netherlands)	Timothy JOHNSON (USA)	Gerhart RINNE(Germany)
Jerzy BAJKOWSKI	Tadeusz KALDONSKI	Roger R. ROGOWSKI (USA)
Wieslaw BARNAT	Ghazi A. KARIM (Canada)	Kazimierz ROMANISZYN
Georg BARTON (Germany)	Takashi KATODA (Japan)	Marek RUDKOWSKI
Wojciech BATKO	Tadashige KAWAKAMI (Japan)	Eugeniusz RUSINSKI
Mustafa BAYHAN (Turkey)	Andrzej KAZIMIERCZAK	Piotr RYBAK
Romuald BEDZINSKI	Rudolf KLEMENS	Tadeusz SALAMONOWICZ
Maciej BERNHARDT	Henryk KNAPCZYK	Alexander SANDEL(USA)
Grace BOCHENEK (USA)	Jan KLOPOCKI	Yoshio SATO (Japan)
Cezary BOCHENSKI	Waclaw KOLLEK	Janusz SECZYK
Zdzislaw BOGDANOWICZ	Czeslaw KOLANEK	Bronislaw SENDYKA
Waclaw BORKOWSKI	Oleg D. KOSOW (Russia)	Eran SHER (Israel)
Ulf G. BOSSEL (Switzerland)	Grzegorz KOWALCZYK	Masahiro SHIOJI (Japan)
Dirk BOSTEELS (Belgium)	Andrzej KOWALEWICZ,	Barbara SIEMINSKA
Bert BREUER (Germany)	Stanislaw W. KRUCZYNSKI	Jan SIKORA
Zbigniew BURCIU	Ryszard KRYPEK	Lech SITNIK
Gintautas BUREIKA (Lithuania)	Jin KUSAKA (Japan)	Paul F. SKALNY
Andrzej CALKA (Australia)	Jerzy KUSMIDROWICZ	Zenon SLAWINSKI
Massimo CAPOBIANKO (Italy)	Nicos LADOMMATOS (UK)	Marek SLEZAK
Adam CHARCHALIS	Kazimierz LASIEWICKI	Marcin SLEZAK
Zdzislaw CHLOPEK	Gvidonas LABECKAS (Lithuania)	Zbigniew SMALKO
Andrzej CHUDZIKIEWICZ	Kazimierz LEJDA	Andrzej SOBIESIAK (Canada)
Suk Ho CHUNG (Korea)	Jan LESINSKY (Slovakia)	Maciej SOBIESZCZANSKI
Marian CICHY	Stefan LISCAK (Slovakia)	Lech SOKALSKI
Andrzej CISZEWSKI	Egbert LOX (Germany)	Leszek STANISLAWSKI
David CROLLA (UK)	Slawomir LUFT	Cezary SZCZEPANIAK
Karol CUPIAL	Jan MACEK (Czech Republic)	Ryszard SZCZEPANIK
Jan CZERWINSKI (Switzerland)	Simon MARTINEZ (Mexico)	Wiktor W. SZECHOWCOW (Russia)
Zbigniew DABROWSKI	John MAY (UK)	Janusz SZPYTKO
Yasuhiro DAISHO (Japan)	Krzysztof MENDERA	Antoni SZUMANOWSKI
Wiktor DANILCZYK	Jerzy MERKISZ	Stanislaw SZWAJA
Gunter H. DEINZER (Germany)	Simona S. MEROLA (Italy)	Krzysztof SZYMANSKI
Roman DOMANSKI	Jan MISIAK	Piotr TARKOWSKI
Julius DREW(USA)	Wladyslaw MITANIEC	Andrzej TEODORCZYK
Andrzej DUKS	Ray MORRIS(USA)	Marek TOMASYCKI
Adam DUZYNSKI	Andrzej MUSZYNSKI	Eiji TOMITA (Japan)
Janusz DYDUCH	Janusz MYSLOWSKI	Dietmar UEBERSCHAR (Germany)
Mieczyslaw DZIUBINSKI	Eugen NEGRUS (Romania)	Andras VOITH (Hungary)
Patrick V. FARRELL (USA)	Antoni NEYMAN	Jan A. WAJAND
Jan FIGURSKI	Adrian I NICULESCU (Romania)	Jerzy WALENTYNOWICZ
Malcolm F. FOX (UK)	Andrzej NIEWCZAS	Wojciech WALKOWIAK
Wieslaw GALOR	Tadeusz NIEZGODA	Harry WATSON (Australia)
Janusz GARDULSKI	Jozef NITA	Wojciech WAWRZYNSKI
Piotr GEBIS	Jerzy NYKIEL	Miroslaw WENDEKER
Jerzy GIRTLEK	Yasuhiro OHTA (Japan)	Ida WIERZBA (Canada)
Marek GRZEGORZEWSKI	Aleksander OLEJNIK	Krzysztof WIERZCHOLSKI
Wieslaw GRZESIKIEWICZ	Wieslaw OLSZEWSKI	Andrzej WILK
Stanislaw GUCMA	Marek ORKISZ	Michael WILLMANN (Germany)
Jerzy HAJDUK	Kenneth OSCAR (USA)	Witold WISNIOWSKI
Daniel M. HANCOCK. (USA)	Oleg OSTAPIUK(Ukraine)	Marek WLODARCZYK (USA)
Herbert HEITLAND (Germany)	Wojciech PATOLA	Andrzej WOJCIECHOWSKI
John B. HEYWOOD (USA)	Krzysztof PAPLINSKI	Piotr WOLANSKI
Vladimir HLAVNA (Slovakia)	Zbigniew PAWELSKI	Maciej WOROPAY
Gunter HOHL (Austria)	Leszek PIASECZNY	Piotr WRZECIONARZ
Marek IDZIOR	Stanislaw PIETROWSKI	Jozef WYSOCKI
Antoni ISKRA	Alvydas PIKUNAS(Lithuania)	Miroslaw L. WYSZYNSKI (UK)
Murli M. IYER (USA)	Franz F. PISCHINGER	Marian ZABLOCKI
Janusz JAKOBIEC	A. W. POBIEDIN (Russia)	Mieczyslaw ZAJAC
Adam JANIK	Marian POLONI(Slovakia)	Edmundas ZAWADZKAS (Lithuania)
Romuald JANIK	Stefan POSTRZEDNIK	Zbigniew ZMUDKA
Antoni JANKOWSKI	Janusz POTOCKI	Bogdan ZOLTOWSKI
Jozef JAROSINSKI	Leon PROCHOWSKI	Jozef ZUREK

Editorial Office

Institute of Aeronautics BK

Al. Krakowska 110/114, 02-256 Warsaw, Poland

tel. +48 22 846 00 11, fax +48 22 846 44 32, e-mail: kones@ilot.edu.pl

This journal is a monograph devoted to the latest achievements in research, development and design of both compression-ignition and spark-ignition as well as other combustion engines (hybrids) with special attention to ecology, combustion processes, mixture preparation, exhaust aftertreatment, electronic control, diagnostics and maintenance, durability and reliability, new materials, engine parts, fuel and lubricants, other alternative fuels (including hydrogen), fuel cells and converters, electric drive standards, noise and vibration, diagnostics (OBD), catalysis, catalyst systems.

The journal is also devoted to the problems of research, design and development for different kinds of vehicles, reliability and durability with a especial attention on novel generation of vehicles, pollution, environment protection, simulation and modelling including land, sea and air vehicles with a particular regard on connection with powertrain, ecology, and safety. The languages of the papers are English and Polish. The preferred spellings are of the Oxford English Dictionary.

All papers were reviewed by the members of the International Editorial Advisory Board (International Scientific Committee of European Science Society of Powertrain and Transport KONES).

This publication or any part thereof may not be reproduced without the written permission of the copyright owner.

All Papers are reviewed

© Copyright by Permanent Committee of KONES

All rights reserved

ISSN 1231 - 4005

Printed and bended in Poland