

Archives of Electrical Engineering

The journal of Polish Academy of Sciences

ISSN: 1427-4221

eISSN: 2300-2506

The International Journal of **Archives of Electrical Engineering** (AEE)
sincerely expresses gratitude to the following individuals who took time to review
papers submitted to the journal (Volume 68 – 2019)

Thabet	Abdeljawad	Turkey	Çankaya Universit, Turkey
Mohammad	Abedi	Iran	University of Zanjan, Iran
Kashif	Abro	Pakistan	Mehran University of Engineering and Technology
Mariusz	Adamski	Poland	Bialystok University of Technology
Dwi ajatmo	ajatmo	Indonesia	Institut Teknologi Sepuluh Nopember
Tahir Cetin	Akinci	Turkey	Istanbul Technical University
Salvador	Alepuz	Spain	Universitat Pompeu Fabra
Maria	ANGELES	Spain	University of Sevilla, Spain
Amjad	Anvari-Moghaddam	Denmark	Aalborg University, Denmark
Yogendra	Arya	India	Maharaja Surajmal Institute of Technology
Pavel	Atănăsoae	Romania	University of Suceava, Romania
Murari	Azad	India	INDIAN SCHOOL OF MINES
Robert S.	Balog	United States	Texas A&M University,
Jerzy	Barglik	Poland	Silesian University of Technology
Bernard	Baron	Poland	Opole University of Technology
Kivanc	Basaran	Turkey	Celal Bayar University
Mahajan	Bhaskar	Qatar	Qatar University
Tadeusz	Białoń	Poland	Silesian University of Technology
Sławomir	Bielecki	Poland	Warsaw University of Technology
Marko	Bošković	and Herzegovina	University of East Sarajevo
Stefan	Brock	Poland	Poznan University of Technology
Adam	Bujnowski	Poland	Gdansk University of Technology
Riccardo	Caponetto	Italy	University of Catania
Kwok-wing	Chau	Viet Nam	Ton Duc Thang University
Yong	Chen	China	University of Electronic Science and Technology of China
Yuan	Chi	Singapore	Nanyang Technological University
Waldemar	Chmielak	Poland	Instytut Energetyki
Seung-Bok	Choi	Korea (South)	Inha University
Krystian	Chrzan	Poland	Wroclaw University of Science and Technology
Marcin	Chrzan	Poland	Kazimierz Pulawski University of Technology and Humanities in Radom
Grzegorz	Cieślar	Poland	Medical University of Silesia
Goga	Cvetkovski	Macedonia	University of Skopie

Herbert	de Gersem	Germany	Darmstadt University
Krzysztof	Derzakowski	Poland	Warsaw University of Technology
Paolo	Di Barba	Italy	Padova University
Pierpaolo	Dini	Italy	
J.	Divya Navamani	India	SRM University
Grzegorz	Dombek	Poland	Poznań University of Technology
M.K.	Döşoğlu	Turkey	Duzce University
Waldemar	Dołęga	Poland	Wroclaw University of Technology Laboratoire Systèmes Electrotechniques et Environnement
Stéphane	DUCHESNE	France	
Stanisław	DUER	Poland	Koszalin University of Technology
Mustafa	Dursun	Turkey	Duzce University
Mateusz	Dybkowski	Poland	Wroclaw University of Science and Technology
Firat	EVİRGEN	Sweden	Balıkesir University
Sylwester	Filipiak	Poland	Kielce University of Technology
Rastko	Fišer	Slovenia	University of Ljubljana
Caixia	Gao	China	Henan Polytechnic University
Baoming	Ge	United States	MSU-PEMD
Zong	Geem	Korea (South)	Gachon University
Sriparna	Ghatak	India	KIIT University,
Wojciech	Giernacki	Poland	Poznań University of Technology
Ryszard	Goleman	Poland	Lublin University of Technology
Marek	Gołębowski	Poland	Rzeszów University of Technology
Tomasz	Grabiec	Poland	Politechnika Opolska, Poland
Asael	Greenfeld	Australia	Curtin University
Maciej	Gwozdiewicz	Poland	Wroclaw University of Science and Technology
Adrian	Halinka	Poland	Silesian University of Technology
Nejib	Hamrouni	Tunisia	ISSAT of Mateur,
Michael	Hartmann	Austria	Schneider Electric
Selcuk	Helhel	Turkey	Akdeniz University
K.T.M.U.	Hemapala	India	University of Moratuwa
Robert	Hoed	Netherlands	University of Applied Sciences Amsterdam
Juan	Home-Ortiz	Brazil	São Paulo State University
Jacek	Horiszny	Poland	Gdansk University of Technology
Kulpash	Iskakova	Kazakhstan	Kazakh National Pedagogical University
Lubomir	IVANEK	Czech Republic	Techhnicka Univerzita Ostrava
Grzegorz	Iwanski	Poland	Warsaw University of Technology
Mariusz	Jagieła	Poland	Opole University of Technology
Kazimierz	Jakubiuk	Poland	Gdansk University of Technology
Maciej	Jaroszewski	Poland	Wroclaw University of Science and Technology
Wojciech	Jarzyna	Poland	Lublin University of Technology
Vesna	Javor	Serbia	University of Niš
Tao	Jianfeng	China	State Key Laboratory of Mechanical System and Vibration
Marcin	Kamiński	Poland	Wroclaw University of Science and Technology
Jacek Kaniewski	Kaniewski	Poland	University of Zielona Gora
Jan	Kanuch	Slovak Republic	Technical University of Košice,

Andrzej	Kaplon	Poland	Kielce University of Technology
Yannis	Karnavas	Greece	Democritus University of Thrace
Mandeep	Kaur Saini	India	Khiala, Jalandhar
Marian	Kazimierczuk	United States	Wtight State University
Aykut	Kentli	Turkey	Marmara University,
Kamel Djamel Eddine	Kerrouche	Algeria	Tahar Moulay University
H. G.	Khodzhibagiyan	Russia	Joint Institute for Nuclear Research,
Marek	KITLIŃSKI	Poland	Gdynia Maritime University
Jerzy	Klamka	Poland	Silesian University of Technology
Jacek	Klucznik	Poland	Gdansk University of Technology
Łukasz	Knypinski	Poland	Poznan University of Technology
			Mineral and Energy Economy Research
Aleksandra	Komorowska	Poland	Institute of the Polish Academy of Sciences
Mongkol	Konghirun	Thailand	King Mongkut's University of Technology
Georgios	Konstantinou	Australia	University of New South Wale
Krzysztof	Kowalski	Poland	Poznan University of Technology
Marcin	Kowol	Poland	Opole University of Technology
Janusz	Kołodziej	Poland	Opole University of Technology
Zbigniew	Krzemiński	Poland	Gdansk University of Technology
Andrzej	Książkiewicz	Poland	Poznan University of Technology
			Agriculture, Environment and Food
Manoj	Kumar Patel	India	Laboratory
C. Bambang	Kuncoro	Taiwan	National Chin-Yi University of Technology
Maciej	Kuniewski	Poland	AGH University of Science and Technology
Alexander	Kushnerov	Israel	Ben-Gurion University of the Negev
Trevor	Kwan	Australia	University of Sydney
King-hang	Lam	China	The University of Hong Kong
D.	Landi	Italy	Università Politecnica delle Marche
Krzysztof	Latawiec	Poland	Opole University of Technology
FC.	Lau	Hong Kong	The Hong Kong Polytechnic University
Fernando	Lessa Tofoli	Brazil	Universidade Federal de São João del-Rei
Jan	Leuchter	Czech Republic	University of Defence
Bin	Li	China	Tianjin University
Kaicheng	Li	China	School of Electrical and ElectronicsEngineering
Wenting	Li	United States	Rensselaer Polytechnic Institute
Yong	Li	China	Hunan University
Roberto	Limão de Oliveira	Brazil	Federal University of Para
Yong	Liu	China	Tianjin University
Tong	Ma	United States	University of Connecticut
Witold	Machowski	Poland	AGH University of Science and Technology
Sułowicz	Maciej	Poland	Krakow University of Technology
Henryk	Maciejewski	Poland	Wroclaw Universiy of Science and Technology
Sreedhar	Madichetty	India	School of Electrical Engineering
Om	Malik	Canada	University of Calgary
Yao	Mao	China	University of Chinese Academy of Science
Luqman	Maraaba	Saudi Arabia	King Fahd University of Petroleum and Minerals
Andrea	Mariscotti	Italy	University of Genoa

Jurifa	Mat Lazi	Malaysia	Universiti Teknikal Malaysia Melaka
Ernest	Mendrela	United States	Louisiana State University
Michał	Michna	Poland	Gdansk University of Technology
Zbigniew	Mikoś	Poland	AGH University of Science and Technology
John	Millar	Finland	Aalto University
Piotr	Miller	Poland	Lublin University of Technology
Slobodan	Mirchevski	Macedonia	University Ss. Cyril and Methodius
Seyedali	Mirjalili	Australia	School of Information and Communication Technology
Sudhansu	Mishra	India	Department of Electrical and Electronics Engineering
Marek	Miśkowicz	Poland	AGH University of Science and Technology
Mohammadreza	Modabbernia	Iran	Technical and Vocational University
Erfan	Mohagheghi	Germany	Ilmenau University of Technology
Behnam	Mohammadi-ivatloo	Iran	University of Tabriz
Seyed	Mohseni-Bonab	Iran	University of Zanjan
Jan	Mućko	Poland	UTP University of Science and Technology
Mahamad	Nabab Alam	India	Indian Institute of Technology
Krzysztof	Nęcka	Poland	University of Agriculture in Kraków
Roberto	Netto	Brazil	Federal University of Itajubá,
Gregory M.	Noetscher	United States	Worcester Polytechnic Institute
K.N.	Nwaigwe	Botswana	University of Botswana
Marek	Ochowiak	Poland	Poznan University of Technology
Paweł	Ockoń	Poland	Cracow University of Technology
O. I.	Okoro	Nigeria	MICHAEL OKPARA University
Paweł	Olejnik	Poland	Lodz University of Technology
Diego	Oliva	Mexico	Universidad de Guadalajara
Stelian	Oltean	Romania	University of Medicine, Pharmacy, Sciences and Technology of Tîrgu Mureș
Antonio	Orlandi	Italy	University of L'Aquila
Teresa	Orłowska-Kowalska	Poland	Wroclaw University of Science and Technology
Marek	Ossowski	Poland	Lodz University of Technology
Mladen	Ostojić	Serbia	University of Belgrade
Lahcen	Ouboubker	Morocco	Hassan II University Casablanca
Sukru	OZEN	Turkey	Akdeniz University
Nammalvar	Pachaivannan	India	Krishnasamy College of Engineering
Thierry	Paillat	France	University of Poitiers
Millie	Pant	India	Indian Institute of Technology Roorkee
Alivelu	Parimi	India	BITS Pilani Hyderabad Campus
Emanuel	Pereira Soares Ramos	Brazil	CEFET-MG - Câmpus Curvelo-MG
Marcelo	Perotoni	Brazil	University of Campina Grande
Dinh	Phan	Viet Nam	The University of Danang-University of Science and Technology
Zygmunt	Piatek	Poland	Częstochowa University of Technology
Wojciech	Pietrowski	Poland	Poznan University of Technology
Stanislaw	Pirog	Poland	AGH University of Science and Technology
Marian	Poboroniuc	Romania	'Gheorghe Asachi' Technical University of Iasi

Janez	Podobnik	Slovenia	University of Ljubljana
Mateusz	Polewaczyk	Poland	Warsaw University of Technology
Ioan	Popa	Romania	University of Craiova
Andrzej	Popenda	Poland	Czestochowa University of Technology
Natarajan	Prabaharan	India	SASTRA Deemed University
K	Premkumar	India	Rajalakshmi Engineering College
Luca	Pugi	Italy	University of Florence
Jacek	Rąbkowski	Poland	Warsaw University of Technology
Jordan	Radosavljević	Serbia	University of Pristina
Sonali	Rangari	India	Shri Ramdeobaba College of Engineering and Management
Boopathi	Rani	India	National Institute of Technology Puducherry
Tarik	Rashid	Iraq	University of Kurdistan Hewle
Federico	Ravotti	Switzerland	ExperimentalPhysics Department
Sanyog	Rawat	India	Manipal University Jaipur
A. A.	Razi-Kazemi	Iran	Teheran University of Technology
Salman	Rezaei	Iran	Kerman Power Generation Management Co.
Jacek	Rezmer	Poland	Wroclaw Universiy of Science and Technology
M.	Rizwan	India	Delhi Technological University
Sylwester	Robak	Poland	Warsaw University of Technology
Daniel	Roger	France	Univiversity of France
Raphaël	ROMARY	France	Faculté des Sciences Appliquées
Khalid	Saffer Alzaidi	Turkey	Faculty of Sciences, University of Diyala
A.K.	Saha	South Africa	University of KwaZulu-Natal
Chitta	Saha	United Kingdom	Coventry University
Swamidoss	Sathiakumar	Australia	University of Sydney
Bartosz	Sawicki	Poland	Warsaw University of Technology
Adrian	ŞCHIOP	Romania	University of Oradea
Gerald	Seet	Singapore	Nanyang Technological University
Piotr	Serkies	Poland	Wroclaw Universiy of Science and Technology
Abdul	Shah	Malaysia	University of Kuala Lumpur
Ghazanfar	Shahgholian	Iran	Islamic Azad University Najafabad Branch
Shahaboddin	Shamshirband	Viet Nam	Ton Duc Thang University
Jikai	Si	China	Zheng Zhou University
Tadeusz	Sikora	Czech Republic	VŠB-Technical University of Ostrava
Wojciech	Sikorski	Poland	Poznań University of Technology
Silvio	Simani	Italy	University of Ferrara
Tejpreet	Singh	India	Lovely Professional University
Urvinder	Singh	India	Thapar University
Pradip	Sircar	India	Indian Institute of Technology Kanpur
Anis	Smara	United Kingdom	University of Cambridge
Albert	Sorgdrager	South Africa	Stellenbosch University
Dariusz	Spałek	Poland	Silesian Univesity of Technology
MOHAN KRISHNA	SRINIVASAN	India	Alliance University
Lubica	Stuchlíková	Slovak Republic	Slovak University of Technology
jegajothi	sudhakar	India	Sriram Engineering College

Karakkat	Sunitha	India	National Institute of Technology Calicut
Mariusz	Świderski	Poland	Poznan University of Technology
Paweł	Szcześniak	Poland	University of Zielona Gora
Adam	Szeląg	Poland	Warsaw University of Technology
Wojciech	Szelag	Poland	Poznan University of Technology
Elżbieta	Szychta	Poland	Kazimierz Pulawski University of Technology and Humanities in Radom
Rodney	Tan	Malaysia	UCSI University
Tomasz	Tarczewski	Poland	Nicolaus Copernicus University
Aleksei	Tepljakov	Estonia	Tallinn University of Technology
Zhongda	Tian	China	Shenyang University of Technology
Paul	Tobin	Ireland	Dublin Institute of Technology
Van	Tsai Liu	Taiwan	National Formosa University
Konrad	Urbanski	Poland	Poznan University of Technology
Aleksandra	Vasić-Milovanović	Serbia	University of Belgrade
Marko	Vekić	Serbia	University of Novi Sad
Blas	Vinagre	Spain	Universidad de Extremadura
Dionisis	Voglitsis	Greece	Democritus University of Thrace
Pei	Wang	China	Jiangsu University
Xiuhe	Wang	China	Shandong University
Yawei	Wang	Scottish	University of Strathclyde
Marcin	Wardach	Poland	West Pomeranian University of Technology
Jurij	Warecki	Poland	AGH University of Science and Technology
Tomasz	Węgiel	Poland	Krakow University of Technology
Marcin	Wesołowski	Poland	Warsaw University of Technology
Bogusław	Więcek	Poland	Technical University of Lodz
Yuan-Kang	Wu	China	National Chung-Cheng University
Romuald	Włodek	Poland	Akademia Górnictwa-Hutnicza,
Huikai	Xie	United States	University of Florida
Min-Kwon	Yang	Korea (South)	Chonbuk National University
wenxin	yu	China	Hunan University
Ryszard	Zajczyk	Poland	Gdansk University of Technology
Konrad	Zajkowski	Poland	Koszalin University of Technology
Ahmed	Zaki Diab	Egypt	Minia University
Qichun	Zhang	United Kingdom	De Montfort University
Xiaochen	Zhang	United Kingdom	The University of Nottingham
Jinguo	Zhao	China	Xijing University
Cheng	Zhong	China	Northeast Dianli University
Niancheng	Zhou	China	Chongqing University
Marek	Ziółkowski	Germany	Technische Universität Ilmenau
Ahmed	Zobaa	United Kingdom	Brunel University London
Marcin	Zygmanski	Poland	Silesian University of Technology
Dominik	Łuczak	Poland	Poznań University of Technology