A journal of the World Institute for Engineering and Technology Education (WIETE)



# GLOBAL JOURNAL OF ENGINEERING EDUCATION

Editor-in-Chief: Zenon J. Pudlowski World Institute for Engineering and Technology Education (WIETE) Glen Waverley, Melbourne, VIC 3150, Australia

**MELBOURNE 2014** 

#### **WIETE Partners**



Association of Taiwan Engineering Education and Management (ATEEM) Taipei, Taiwan



Technological Education Institute of Piraeus Piraeus-Athens, Greece



College of Engineering & Engineering Technology Northern Illinois University DeKalb, Illinois, USA



UNIVERSITT OF BOTSWANA

University of Botswana Gaborone, Botswana



Commonwealth Science and Technology Academy for Research (C-STAR) Chennai, India



Polytechnic Institute of New York University New York, USA

Published by:

World Institute for Engineering and Technology Education (WIETE) 2/90 Marshall Street, Ivanhoe, Melbourne, VIC 3079, Australia

E-mail: info@wiete.com.au Internet: http://www.wiete.com.au

© 2014 WIETE

ISSN 1328-3154

Articles published in the *Global Journal of Engineering Education* (GJEE) have undergone a formal process of peer review by international referees.

This Journal is copyright. Apart from any fair dealing for the purpose of private study, research, criticism or review as permitted under the Copyright Act, no part may be reproduced by any process without the written permission of the publisher.

Responsibility for the contents of these articles rests upon the authors and not the publisher. Data presented and conclusions developed by the authors are for information only and are not intended for use without independent substantiating investigations on the part of the potential user.

## **Global Journal of Engineering Education**

EDITOR-IN-CHIEF

Prof. Zenon J. Pudlowski	World Institute for Engineering and Technology Education (WIETE) 2/90 Marshall Street, Ivanhoe, Melbourne, VIC 3079, Australia Tel/Fax: +61 3 94994339, E-mail: zenon.pudlowski@wiete.com.au Internet: http://www.wiete.com.au	
MANAGER & ASSOCIATE EDITOR		
Dr Dianne Q. Nguyen	WIETE, Melbourne, Australia	
ASSOCIATE EDITORS		
Dr Ian R. Dobson Ms Krystyna Wareing	Monash University, Melbourne and University of Ballarat, Ballarat, Australia Independent Communications Consultant, Crawley, West Sussex, England, UK	
ADVISORY BOARD MEMBERS		
Prof. Hosni I. Abu-Mulaweh Prof. Colin U. Chisholm Prof. Ahmad Ibrahim Prof. Adinarayana Kalanidhi Prof. Krzysztof Kluszczyński Prof. Romanas V. Krivickas A/Prof. Wojciech Kuczborski Prof. George Metaxas Prof. George Metaxas Prof. Andrew Nafalski Prof. Derek O. Northwood Prof. Gyula Patkó Prof. Dieter Schott	Indiana University-Purdue University Fort Wayne, Fort Wayne, USA Glasgow Caledonian University, Glasgow, Scotland, UK Yorkville University, Toronto, Ontario, Canada Commonwealth Science and Technology Academy for Research, Chennai, India Silesian University of Technology, Gliwice, Poland Kaunas University of Technology, Kaunas, Lithuania Edith Cowan University, Perth, Australia Technological Education Institute of Piraeus, Piraeus-Athens, Greece University of South Australia, Adelaide, Australia University of Windsor, Windsor, Canada University of Miskolc, Miskolc-Egyetemváros, Hungary Hochschule Wismar - University of Technology, Business and Design, Wismar, Germany	
Prof. David W.S. Tai Prof. Jacek Uziak Prof. Algirdas V. Valiulis Prof. Promod Vohra	HungKuang University, Taichung, Taiwan University of Botswana, Gaborone, Botswana Vilnius <i>Gediminas</i> Technical University, Vilnius, Lithuania Northern Illinois University, DeKalb, USA	

A journal of the World Institute for Engineering and Technology Education (WIETE)

## **Global Journal of Engineering Education**

#### Contents

Z.J. Pudlowski	58	Editorial
J. Ilkovič, L. Ilkovičová and R. Špaček	59	To think in architecture, to feel in structure: <i>Teaching</i> <i>Structural Design</i> in the Faculty of Architecture
K.J. Dick, J. Carter and S. Ingram	66	A service learning project in Honduras as an enhancement to the undergraduate engineering design experience
A.S. Bappah	74	Robust design with PID controllers for implementing undergraduate students' laboratory exercises
A. Maffei, P. Neves, J. Dias-Ferreira and J. Barata‡	80	Characterisation of the student perception of the concept of flexibility in the manufacturing domain: highlighting the patterns of effective learning
S. Heikkinen	88	Bonus exercises as motivational aspects in the learning process
C-H. Huang	93	Engineering students' generating counterexamples of calculus concepts
Index of Authors	98	

A journal of the World Institute for Engineering and Technology Education (WIETE)