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**PROCEEDINGS**  
**INTERNATIONAL CONFERENCE ON**  
**AGRICULTURAL AND FOOD ENGINEERING 2012**  
*“Bringing Engineering to Life”*  
**(CAFEi 2012)**

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**PROCEEDINGS**  
**INTERNATIONAL CONFERENCE ON**  
**AGRICULTURAL AND FOOD ENGINEERING 2012**



**CAFEi 2012**

**“Bringing Engineering to Life”**

November 26 – 28, 2012

The Palm Garden Hotel, Putrajaya

**ORGANIZED by:**



Department of Process and Food Engineering & Department of Biological  
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Pertubuhan Peladang Negeri Perak

# *Welcome from the Honourable Secretary General*



## **MINISTRY OF AGRICULTURE AND AGRO-BASED INDUSTRY, MALAYSIA**

First of all, I would like to congratulate the organizing committee on their commendable effort in establishing and preparing this 3-day-event. As we are all aware, the conference is organized as an event of nation's leading agricultural expo, MAHA International 2012. This year, MAHA International 2012, themed with "Agricultural Transformation through Innovation", is intended to boost up the capacities and the competencies of producers and industry players through adoption of technology and best practices. Therefore this eventful conference is indeed a timely-moment as it will be a platform for us to bring and share the latest research ideas, findings and technologies in these fields of food production, trading and related agro based industries.

The significant efforts and initiatives that have been made to organize this 3-day international conference reflect the key role that the agriculture and food sector play in economic growth. It is hence the missions of the Ministry of Agriculture and Agro-based Industry's (MOA's) "to transform the agriculture and agro-based industry into a modern, dynamic and competitive sector, to position Malaysia as a major world food exporter, and to develop the agriculture sector as the country's engine of growth.

Thus, we are here to address the importance of bringing engineering and innovation benefits to the agriculture sector and eventually underlining the ideas and strategies to reach sustainable agriculture and to achieve self sufficiency in food production. In fact, research in agriculture and food engineering as well as sustainable management of natural resources including land, water and soils have been shown to give a significant impact on the growth of agriculture and food sector in developing countries. Therefore, it is expected that this conference will be utilized up to the most in exploring the potential of using scientific knowledge, practical ideas, and emerging technologies for humankind.

Finally, I would like to once again to take this opportunity to congratulate the organizers who worked hard for the last few months to make this conference a success. I hope the conference will successfully cover the promising research and new engineering solutions that can benefit the agriculture sector and rural activities. It is hoped that we are able to shed further light on the potential for improvements in the agriculture sector through innovation, researches, application of new technologies and best practices.

**Dato' Mohd Hashim Bin Abdullah**

Secretary General of Ministry of Agriculture and Agro-Based Industry

# *Welcome from the Vice Chancellor*

## **UNIVERSITI PUTRA MALAYSIA (UPM)**



On behalf of the Organizing Committee and Universiti Putra Malaysia, I would like to extend to all of you a very warm welcome to this conference. As we all understood, the three-day-conference will be highlighting the importance of bringing engineering benefits to the improvement of agricultural and food sector. This objective can be emphasized by taking Malaysia with the issue of food security and sustainable agriculture as examples. To achieve these objectives, we as part of global academia community need to identify the way we can approach food security and sustainable agriculture, in particular by unleashing the potential of engineering research and innovation that can bring significant impact to the development of agriculture and food sector. While many of us come from different backgrounds, expertise, and countries, we all share the same aspiration to contribute

and bring fresh ideas to the agriculture and food engineering research and eventually improve the global agriculture and food sector.

The past decades have observed an impressive change in agriculture and food sector. Traditionally the performance and the contribution of these sectors have been undervalued. However in recent years, both sectors have made convincing contribution to the many countries economic growth. Food security and safety, rapid population growth, extreme weather, climate change, land use competition, water scarcity and market volatility are some of the global challenges that are faced by the agriculture and food sector. As part of the scientific community, we hold an essential role in informing strategic investments to establish climate-resilient agricultural production systems, reducing greenhouse gas emissions, making efficient use of resources, developing low-waste supply chains, ensuring adequate nutrition, encouraging healthy eating patterns and developing a global knowledge system for sustainability. In the mean time, collaboration of R&D team between institutions and industry as well as the exchange of R&D personnel between the two sectors should be encouraged. Therefore I look forward to see this kind of conference to be held more often in the future, as this is one of the most effective means to ensure knowledge and innovation transfer within education world.

On this occasion, I would like to take this opportunity to thank the organizers who worked hard for the last few months to make this conference a success. Thank you also to paper and poster presenters, exhibitors and to all participants, local and foreign, for your contributions. Lastly, I sincerely hope that after the deliberations during the conference all participants will be equipped with a wealth of knowledge.

**Dato' Ir. Dr. Radin Umar Radin Sohadi**

Vice Chancellor of Universiti Putra Malaysia

# *Welcome from the Chairperson of the Organizing Committee*



## **INTERNATIONAL CONFERENCE ON AGRICULTURAL AND FOOD ENGINEERING 2012 (CAFEi 2012),**

### ***“Bringing Engineering to Life”***

Thank you for joining us at the International Conference on Agricultural and Food Engineering for Life 2012 (CAFEi2012). We have more than 100 participants from various countries gathered here in this conference, making our program a truly international one. CAFEi2012 is organized in conjunction with the Malaysian Agriculture, Horticulture and Agro-tourism Exhibition (MAHA 2012), which is certainly amongst the largest and most comprehensive show of its kind in the region. This conference is an opportunity for us to discuss key issues in engineering research and to strategize how we could bring the engineering solutions through safe and secured agricultural and food production systems under clean and sustainable environment.

We are proud to be the host for this event, which brings together renowned experts in their respective fields to address the vital issues in agricultural and food engineering research. The theme of this three-day conference is “‘Bringing Engineering to Life’”. With many research activities now taking on agriculture and food, it is necessary to discuss positive approaches in engineering path towards contributing to sustainable agriculture for the country with the aim to reach self sufficiency in food production. In an increasingly globalised world, there is a critical need to expand engineering research and studies that can contribute to the growth of Agricultural and Food industry. To this end, the CAFEi2012 shall serve as a platform to discuss the latest ideas and inspirations in agriculture and food engineering as well as potential solutions to face the challenges that the industries are experiencing today. By the end of the conference, we intend to formulate national and international framework for promoting research as well as to identify new ideas and technologies that can bring benefit to humankind especially in ensuring food security.

At this juncture, I would like to take the opportunity to thank the other members of Organizing Committee for their hard work and effort in planning and coordinating this event. I would also like to acknowledge the financial support of many organizations and individuals who have contributed to this conference. Last but not least, I encourage delegates to participate actively in the interesting discussions over the next three days. I wish everyone a successful and fruitful conference.

**Assoc. Prof. Dr. Khalina Abdan**

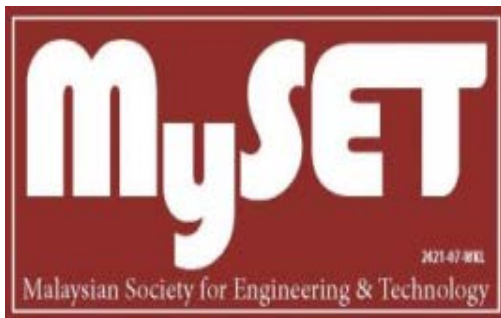
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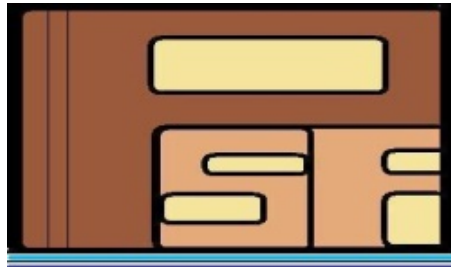


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# Keynote Address I

By Prof. Xiao Dong Chen  
(Monash University Australia)



## Biography

Born in Beijing in 1965, Professor Xiao Dong Chen graduated with a BE in Engineering Mechanics from Tsinghua University (1987), then completed his PhD in Chemical and Process Engineering at Canterbury University in New Zealand (1991). After working for Fonterra New Zealand (a Global Dairy Company) for 2.5 years as a process engineer, he took up a lectureship at the University of Auckland (NZ). Over his 19-year academic career, he has authored and co-authored over 370 refereed journal articles and 200 conference papers, 3 books, 14 book chapters, and over 51 reports on industrial consulting projects. He was made a Chair Professor of Chemical Engineering in 2001 at Auckland. He was appointed to the Chair of Biotechnology at Monash University in 2006 in Melbourne, Australia.. He has worked extensively with industries in New Zealand and in Australia, and has also initiated large projects working with several Chinese companies. He has received many awards of distinction He was the Deputy Head of Chemical Engineering and Associate Dean for the Faculty of Engineering at Monash (2007-2009). He is a Fellow of Royal Society of New Zealand and a Fellow of Australian Academy of Technological Sciences and Engineering, and a Fellow of IChemE. He holds a 1000-Talents Chair Professor of Chemical and Biochemical Engineering at Xiamen University, concurrently a fractional Professor of Chemical Engineering at Monash University, Australia. His research area covers drying, powder technology, fouling and cleaning, bio-inspired process engineering and in vitro digestion track modelling.

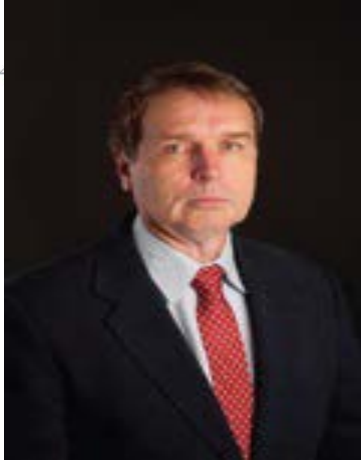
## Abstract

### Developing the Near Real In-Vitro Digestion Track Models For Food Applications – More Scientific and Healthier

It is highly desirable to construct an in-vitro digestion track model that can mimic, to the fullest possible extent of what is going on in a targeted animal or human digestion system. This model system may serve as an effective means to minimize tests on animals, and humans at the early developing phase of functional foods or pharmaceutical products. In literature to date, many studies employed simple in-vitro systems, which may not reflect the reality. From a scientific point of view, trying to assemble a physiological system from the known materials (which may or may not be of a biological origin), to achieve the required biological functions, is challenging but certainly helping to improve our understanding of the real systems. Despite that there has been a number of attempts made in recent years to realize such a 'dream' and some systems have even gone to 'commercials', there is still a long way before such a system to become a true reality. Here, the 'near-real' physio-chemical systems, which mimic the mechanics of the GI systems, are highlighted. The "near-real" *in-vitro* digestion models may refer to the systems that not only resemble chemical changes but also physically mimic the movements and geometrical (including microstructural) details of the real GI systems. In-vivo studies are more crucial in gaining quantitatively knowledge of the living organisms. However, ethical constraints, costs and the time required by these studies restrict the ability in getting a large number of data within short time frame. As such, the pre-clinical studies using "near real" in vitro system are important steps for screening the ideas and the chemicals, and the bio-chemicals of interest. Rapid generation of useful results with robustness and high repeatability are in strong demand to meet fast developing industries of pharmaceuticals and nutritional products, as well as in examining novel, toxic or unfamiliar compounds.



## Keynote Address II



*By Prof. J.K. Schueller  
(University of Florida USA)*

### *Biography*

Prof Schueller obtained his bachelor degree in Mechanical Engineering in 1977, and completed his Masters and PhD in Agricultural Engineering from Purdue University. He is now a Professor in University of Florida and teaches and advises students in both Agricultural and Biological Engineering and Mechanical and Aerospace Engineering departments. His main research interest is in design, automatic controls and manufacturing, especially for agricultural equipment and off-highway vehicles. He had conducted research on milling of hardened die and mold steels and titanium alloy, high-speed milling and drilling of aluminum and magnesium alloys, biomass size reduction, agricultural machinery, integrated hydraulic system design, spatially-variable control of mobile equipment, precision agriculture, robotics, advanced manufacturing engineering, power-split continuously-variable transmissions, and control of various types of mechanical engineering systems, especially hydraulics. Prof Schueller has contributed and involved in many international activities in various institutions and companies including in Mexico, India, China, Norway and Sweden. Due to his vast experience, Prof Schueller was appointed as a Professor in Kyoto University in 2010, and fellow in the American Society of Agricultural & Biological Engineers and in Society of Automotive Engineers. Prof Schueller also had obtained several awards, locally and internationally, namely the Pinkey Award from American Helicopter Society, Vasey Award from the University of Melbourne and Magoon Awards from Purdue University.

### *Abstract*

#### **Integration of Mechanical, Electrical, and Systems Engineering in Agriculture and Food Production**

There is an ever-increasing need for agriculture to produce more food, feed, fiber and fuel as the world's population increases and demands higher living standards. While production and efficiency must increase, there must also be improvements in quality and environmental, economic, and social sustainability. Engineering technologies, along with the agronomic and horticultural sciences and other disciplines, have been great contributors to the past successes in improving agricultural production. Recent examples of the research and commercialization of mechanical, electrical, and systems technologies are presented, including techniques used in corn and citrus production. However, truly significant improvements might be more easily achieved if the diverse mechanical, electrical, and systems technologies were truly integrated in systems developed to maximize performance. Some potential integrated systems are proposed and their critical issues enumerated and discussed. For example, spectrometric and machine vision sensors are now significantly more powerful and inexpensive and can therefore be integrated into mechanical machines which are being controlled to improve overall system performance. These machines can bring new technologies to agricultural production, such as robotic weed control. To support this new era of integrated engineering, the traditional separation of engineering education into different technology areas needs to be overcome. The next generation of agricultural engineers must be competent in mechanical, electrical, and systems engineering, as well as understanding agricultural production. That is a challenging task.

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