Process Industries Division (PID)

2014 Winter Newsletter

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MESSAGE FROM THE CHAIR

by Florin Iancu, Director of Engineering at TURBOdesign Technology

It is my pleasure to serve as the Process Industries Division's Executive Committee Chair for a second term, especially during this period. As I was saying a year ago, PID found itself in the best position for the last 10 years, and now I am happy and proud to say, that this year PID is doing even better. Although the membership numbers are not higher, the active membership numbers are growing – and by "active" membership, I am referring to the PID members that are actively involved in PID sponsored activities, and who contribute to the growth and development of this division.

Although I don't have the editorial space to thank each one of these members for their efforts, I want to thank the members of the Executive Committee and the Technical Committees: Vice-Chair – Prof. Tiruvadi Ravigururajan, Secretary and Treasurer – Dr. Srinivasa Jeyakumar, Program Chair – Dr. Qubo Li, Communications Officer – Mr. Paul Glanville and Member at Large – Dr. Guy Phuong, Prof. Raj Manglik – Water Technology and Sustainability, Dr. Hal Strumpf – Heat and Mass Transfer, Dr. Guy Phuong – Compressor Technology, and Prof. Subha Kumpaty – Engineering Education.

At the ASME level, the fiscal year 2013-2014 as well as the following one will be a very intense one – with major changes both at the society structure level, as well as at the content and membership focus level. The new ASME ONE promises a more streamlined approach the membership needs, less bureaucracy and faster implementation of ideas, programs and events beneficial to the ASME engineering world.

Let's take a quick look at the past year's highlights.

- Former PID Executive Committee Chair and current PID Advisory Board Chair, Dr. Steven Beale was the winner of the ASME Dedicated Service Award.

- Former PID Executive Committee Chair Prof. Abraham Engeda was nominated for the Henry R. Worthington Award of the ASME.

- The International Mechanical Engineering Congress and Exhibition (IMECE) 2012 and 2013 brought a record number of papers in PID sponsored tracks and sessions – 85 papers in 2012 and 95 papers in 2013.

- PID participated in the Heat Transfer Division Summer Conference, co-sponsoring two symposiums in honour of Prof. Bergles and Prof. Spalding, both lecture series gathering a large audience.

- The PID Best Paper Award was reinstated, with winning papers at IMECE 2012 and IMECE 2013 – see the abstracts in the newsletter.

- The Citrus Engineering Technical Chapter of Florida Section joins PID as a new technical group, and we look forward for the first PID Citrus Engineering Conference this March.

What will the fiscal year 2014-2015 bring to PID?

As usual PID will have a very strong participation in the 2014 International Mechanical Engineering Congress and Exhibition, which will be held in Montreal, Canada, 14-20 of November, and the Summer Heat Transfer Conference which will be held in Atlanta, Georgia, 16-20 of June. New for this year will be the Annual Citrus Engineering Conference under the PID patronage, in March. The main technical activities of the Process Industry Division continue to be energy efficiency and resource preservation related, as well as providing guidance to young engineers through the Engineering Education Committee. To better fulfill the scope of the division, PID has expanded – and is striving to further expand – the collaboration with other division and groups within ASME.

The Process Industries Division is striving to provide more help to the non- engineering community with engineering activities and we are also seeking ways to give back to the world by involvement in programs like Engineering for Change, Engineers Without Borders and ASME's Global Communities. PID is further planning to introduce more forms of recognition of its members for both technical achievements and volunteering efforts. Besides the revamped PID Best Paper Award offered at IMECE, and all the other awards the PID has sponsored for some time (James Harry Potter Gold Medal and Henry R. Worthington Medal), the division will be introducing other awards, more specialized to certain technical areas, as well as a career achievement award.

Last, but not least, if you want to take an active role in PID, either by joining one of the Technical Committees or by participating in the Executive Committee meetings, I strongly encourage you to contact me, or any other member of the Executive Committee – we can always do more for the community. For the past two years we have been meeting monthly via teleconferences and at least twice a year in person. Also, don't forget to visit the PID website for updated information regarding events and activities – https://community.asme.org/process_industries_division/default.aspx/

If you have not filled out your profile in ASME.org, you should make this a priority as it allows you access to the Process Industries Division Group Page as well as your Technical Committee Group page. If you have a LinkedIn account, you can quickly import information to complete your ASME.org profile.
Once you complete your profile you can then participate in an existing online group or create your own group based on a specific engineering discipline, your interests, or even your university alumni. You manage group participation, content, tools, and activities. The rich suite of ASME.org functionalities makes it easy for you to lead and grow your own group. It's a great opportunity to network, collaborate,

and showcase your leadership skills to like-minded engineers.

I would like to use this opportunity to welcome several PID members that volunteered to take an active role in the PID mission:

- ***Prof. Anabela C. Alves*** – Assistant Professor at University of Minho, School of Engineering, Department of Production Systems, Portugal

- ***Prof. Behnam Bahr*** - Associate Dean for Research and Graduate Studies at California State Polytechnic University, Pomona CA

- ***Prof. Gisuk Hwang*** – Assistant Professor at Wichita State University, Mechanical Engineering Department, Wichita, KS

- ***Prof. Franz-Josef Kahlen*** – Associate Professor at University of Cape Town, Department of Mechanical Engineering, South Africa

I look forward to working with all of you in this New Year.

Florin Iancu, Ph.D.
TURBOdesign Technology, Inc.
80 Broad Street, 5th Floor, New York City, NY 10004
f.iancu@turbodesign-tech.com
(240) 515-6429

Dr. Steven Beale – Short Bio of the Winner of the Dedicated Service Award:

Dr. Steven Beale has been an active member of ASME for more than three decades, starting as a student member in 1981 and becoming a Fellow of ASME in 2007. During this time, Dr. Beale has volunteered in many divisions and committees, in technical and executive roles, and also as an awards and recognitions officer. He has been active in Process Industries Division, Heat Transfer Division, Research Committee on Sustainable Products and Processes, and most recently CRTD Research Committee on Water Management Technology and Energy-water Nexus Interdisciplinary Council. His field of expertise is broad, and he is recognized for his work on heat transfer, fuel cells and sustainable products and processes, Dr. Beale was a Principal Research Officer at the National Research Council and an Adjunct Professor at Queen's University in Canada, and currently he is a scientist at Forschungszentrum Jülich, in Germany.

Prof. Abraham Engeda – Short Bio of the Nominee for Henry R. Worthington Award:

Prof. Abraham Engeda is a professor at Michigan State University of turbomachinery and the director of MSU Turbomachinery Lab. He has made outstanding and long lasting contributions in research and education for designing efficient pump/compressor and understanding its complex flow structure using experimental and theoretical techniques, as a result training the next generation of engineers in sound pump/compressor theory and design principles. He also has a long dedicated service history with ASME, currently an ASME fellow. He has been active in Process Industries Division, Compressor Technical Committee and the Executive Committee Program Chair.

THE FUTURE OF RESOURCE RECOVERY

by Srinivasa Jeyakumar, PE, Mechanical Engineering Specialist with Suncor Energy

What is Resource Recovery?

Resource recovery is the process of building, reprocessing or developing new products such as recycling, composting or energy generation from disposed product/materials. The purpose of resource recovery is to extract the maximum benefits from the products, delay the consumption of virgin natural resources, and to produce the minimum amount of waste by disposing in a suitable, environmentally friendly manner.

Resource recovery is a key component of a business' ability to maintaining ISO14001 accreditation. Extended producer responsibility is meant to impose accountability over the entire lifecycle of products and packaging introduced to the market. This means that firms, which manufacture, import and/or sell products, are required to be responsible for the products after their useful life as well as during manufacture.

How much do we waste?

With seven billion individuals in this world, we produce a lot of trash. In the U.S. alone, each person produces 4.6 pounds of trash each day, and 150 million tons of municipal solid wastes (MSW) was discarded in landfills in 2012. Just over 35% of that was recycled.

An example of Electronics waste:

In theory, recycling gold from old computer motherboards is far more efficient and less environmentally destructive than extracting it from the earth, often by surface-mining that risks unspoiled rain forests!

Consider that over 100 million televisions, computers, monitors and cell phones become obsolete each year because of new technology. According to the Environmental Protection Agency, electronics make a major contribution to the USA generation 1.4 to 1.9 million tons of e-waste per year and up to the 50 million tons of e-waste annually produced worldwide.

The United Nations Environmental Program (UNEP) estimates that only about 10% of tens of millions of tons of electronic waste, or e-waste, are generated around the world each year is properly recycled.

Why do we recycle?

Recycling conserves our natural resources, saves landfill space, conserves energy, and reduces water pollution, air pollution and the greenhouse gas emissions that cause global warming.

There are some ISO standards related to recycling such as ISO 15270:2008 for plastics waste and ISO 14001:2004 for environmental management control of recycling practice.

What are the Advanced Technologies?

Current resource recovery technologies fall into three stages: (1) Recycle and reuse: usable wastes are directly used in the original production processes or become useful materials of other production processes after waste exchange. (2) Renewal and recovery: wastes are turned into other valuable products according to their characteristics with the existing ceramic technologies and chemical engineering technologies. (3) Upcycle, where your recycled product has more value than the original product. Upcycling is the process of converting waste materials or useless products into new materials or products of better quality or for better environmental value. They do it in the clothing industry, taking old out-of-style clothes worth $1-10 and tailoring them together in bits and pieces into fashionable items that are priced at $100+

a) Some of the advanced technologies in recycling are listed below:
b) a) Plastics: The incineration of plastics produces air pollution by releasing chemicals such as hydrogen chloride, dioxin and fine particulate matter.

Because plastics pose a threat to human and wildlife health, different resins are not compatible with others, Plastics also have additives to make the flame retardant or flexible or resistant to UV damage, it is nearly impossible to obtain a homogenous plastic mixture with uniform mechanical properties.

There is a new approach where a specific solvent is used to dissolve PVC, filter, precipitate the regenerated PVC compound and then dry. This was used after the London Olympics 2012 to fulfill the PVC Policy.

b) Organic and polymer: In addition to the traditional liquidation and coal gasification of materials, carbonation has become a new trend for recycling organic and polymer materials. Major methods include direct carbonation, liquidation and coal gasification. The carbonation falls into the low-temperature and high-temperature carbonation. In low-temperature carbonation (200-500°C), as it consumes great activation energy for carbonized reaction at low temperature, the reaction speed is very slow. In high-temperature carbonation (800°C), the speed of diffusion controls the process.

a) Li battery: Currently, common methods for recycling Li-battery include the pyrometallurgy and hydrometallurgy. (1) Pyrometallurgy: Metals containing in Li-batteries are separated for recycling by means of kilning. As the treatment of Li-batteries is dangerous, it is necessary to isolate them from water and air. In general, it is practiced in the presence of gas nitrogen or argon. (2) Hydrometallurgy: after discharging, shell-removing and cutting, fragments of Li-batteries are placed in the absorption chamber where inorganic acidic solvent is sprayed on them. Then, the electrolyte solution and metallic Li are extracted and absorbed before purification for regeneration and reuse. Metals in the residue are separated according to their characteristics and purified before regeneration and reuse. Li-batteries are put inside salt solution or connected to a load for discharging.
b) Organic waste: Plasma gasification is a process, which converts organic matter into synthetic gas, electricity, and slag using plasma. It is used commercially as a form of waste treatment and for the gasification of biomass and solid hydrocarbons, such as coal, oil sands, and oil shale.

What are some of the most innovative technologies?

Newspaper-powered cars - Recently, researchers at Tulane University in New Orleans, US discovered a strain of bacteria that can turn paper into butanol, a biofuel that can be used in some cars in place of regular petrol.
The bacteria called TU-103, which is believed to be the first natural bacterial strain to make butanol directly from cellulose – the material available in all green plants, and old newspapers. In the United States alone, at least 323 million tons of cellulosic materials that could be used to produce butanol are thrown out each year.

Reverse vending machines - At this point of time, it's not in our regular routine in many countries to gather our tin cans and plastic bottles, walk to the local recycling center (if one is available), and dump it there. That's why some countries like Scotland, Japan and the US are introducing Reverse Vending Machines. As its name suggests, instead of dispensing canned and bottled drinks, these machines actually take in empty cans and bottles, and dispense out dockets that can in turn be exchanged for cash.
Foam eater - In 2006, scientists at the University College Dublin found a bacterium that eats polystyrene foam and turns it into a useable plastic. The foam first must be heated without the presence of oxygen and converted into styrene oil. Then, it is fed to the bacteria who convert it into PHA, a biodegradable plastic. It can be used to create packaging film and plastic forks. Unlike polystyrene foam, it is able to biodegrade in water and soil.
Car recycling in Japan - When the car is all hollowed out, the remaining body is pressed into dice-sized chips and processed into metal scrap. At the end of the process, more than 90% of the car's material is recycled, the highest in the country, and as more research and development goes into this field, we could even see 95% of cars there being recycled.

What are the criticisms and responses?

Complete recycling is impossible from a practical standpoint as highly dispersed wastes become so weak that the energy needed for their recovery becomes increasingly unwarranted. Substitution and recycling strategies only delay the depletion of non-renewable stocks and therefore may buy time in the transition to true or strong sustainability, which ultimately is only guaranteed in an economy based on renewable resources.

For example, how will it ever be possible to recycle the numerous chlorinated organic hydrocarbons that have bio-accumulated in animal and human tissues across the globe, the copper dispersed in fungicides, the lead in widely applied paints, or the zinc oxides present in the finely dispersed rubber powder that is abraded from automobile tires?

In the strictest sense, recycling of a material would produce a fresh supply of the same material—for example; used office paper would be converted into new office paper, or used foamed polystyrene into new polystyrene. Specifically, critics argue that the costs and energy used in collection and transportation detract from (and outweigh) the costs and energy saved in the production process; also that the jobs produced by the recycling industry can be a poor trade for the jobs lost in logging, mining, and other industries associated with virgin production; and that materials such as paper pulp can only be recycled a few times before material degradation prevents further recycling. Proponents of recycling dispute each of these claims, and the validity of arguments from both sides has led to enduring controversy.

What is the economics behind this resource recovery?

As global consumption of a natural resource grows, its depletion is inevitable. The best recycling can do is to delay. Complete closure of material loops to achieve 100 percent recycling of non-renewables is impossible as micro-trace materials dissipate into the environment causing severe damage to the planets ecosystems. Historically, this was identified as the metabolic rift by Karl Marx, who identified the unequal exchange rate between energy and nutrients flowing from rural areas to feed urban cities that create effluent wastes degrading the planets ecological capital, such as loss in soil nutrient production. Energy conservation also leads to what is known as Jevon's paradox, where improvements in energy efficiency lowers the cost of production and leads to a rebound effect where rates of consumption and economic growth increases. This can increase the scale of impact on the environment.

What's next? Effective Recyclemania!

Using the powerful facts of environmental damage and climate change reinforce the need for all of us to live a greener lifestyle, making changes where we can, and also communally foreseeing a brighter future for us all.

From the viewpoint of ecology, low-carbon requirements and resource recovery are natural trends in the future, and the prospect of the resource recovery industry is very promising.

However, to understand the property of wastes and value-added technologies is the prerequisite to resource recovery in order to maximize the advantages of resource use, to minimize impacts on environment, and so to achieve sustainable development of industries. Based on the current consumption rate, the remaining petroleum and major metals will be used up within the next five decades. For this reason, waste reuse and development has become the mainstream in the future. Therefore, countries in the world have gradually made the effective use of resources the new direction of environmental policies and the focus of environmental management.

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ANALYSIS OF PHASE CHANGE MATERIALS FOR SOLAR THERMAL POWER PRODUCTION

An interview with Yoram Kozak, a Ph. D Student at the Ben-Gurion University of the Negev in Israel, by Paul Glanville

At the close of 2012, it was a banner year for renewable energy with renewable power production reaching new highs in the U.S.. While a significant fraction of new renewable capacity installed in 2012 was wind generation, with new wind capacity surpassing all other types of power production (including natural gas), construction on several high profile large scale solar thermal generating plants made progress in 2012. In particular, the largest solar thermal power station in the world, the Ivanpah Plant in the Mojave Desert of California, is nearing completion. When deployed for electricity generation, solar thermal power stations operate on the well-known Rankine cycle, where the thermal energy source from the sun is concentrated by mirrors onto an intermediate heat transfer fluid (e.g. molten salt), which in turn drives a steam generator.

An unavoidable issue with renewable energy production, particularly when deployed as baseload power generation in the case of concentrating solar power (CSP) stations, is intermittency of the renewable resource. With thermal energy systems, a common technology used to even out the variable output of renewable systems are phase change materials (PCM). Put simply, PCMs are thermal batteries, used to store and release thermal energy. The design and deployment of PCM materials is, pardon the pun, a hot area of research and development these days, as was found while attending the 2013 Summer Heat Transfer Conference in Minneapolis, MN. An active researcher in this area, Yoram Kozak is pursuing his Ph. D at the Ben-Gurion University of the Negev in Israel. The following is a brief interview with Yoram concerning his research and navigating the first year of his Ph. D program:

PG: How did you initially get into your research concerning latent energy storage and its application to grid stability?

YK: The research is part of a funded program by the Israeli Ministry of Science, focusing on latent heat storage for solar-thermal power plants. The field of technological developments for energy sustainability was always one of my main interests. So when my adviser offered me to join this research program, I was immediately interested.

PG: The work presented had both experimental and simulation results, how difficult was it to come up the learning curve for these computational tools and experimental methods? Were they introduced to you in your coursework?

YK: My M.Sc. thesis was about the use of latent heat for cooling of electronic equipment, so I had gained some knowledge in this field before I started my Ph.D. The present experimental setup was designed by me and a B.Sc. student who also performed the experiments. The simulations required some knowledge that is beyond the scope of any coursework in my university. Many of the analytical/numerical methods were available in the literature and the research included a combination and implementation of different approaches to our specific problem. Also, the knowledge and experience of my adviser, Prof. Gennady Ziskind, who is an expert in this field, helped a lot. Difficulties are unavoidable so both experimental and theoretical results required a lot of time and effort, from me and the other group members.

PG: Beyond what you presented, what work remains before you complete your university program? Afterwards, do you foresee yourself entering this field, developing and manufacturing thermal storage solutions for electrical grid stability or other processes?

YK: I am now finishing the first year of my Ph.D., so according to the rules here I have three more years to go. We are planning to improve further the numerical modeling to take into account complex phenomena such as convection in the melt, yet allow a general solution approach for any geometrical setup. I believe that thermal storage will be part of my future interests, along with other fields in energy sustainability technology.

PG: What other applications of latent energy storage interest you?

YK: Beside thermal storage for solar-thermal power plants, there many other thermal storage applications, for example cold storage for air-conditioning systems. The use of latent heat for enhancing the thermal performance of heat sinks that cool electronic equipment is also one of my interests.

PG: Is this your first time attending and/or presenting at the Summer Heat Transfer Conference? How was the experience overall?

YK: It is the first time that I am attending the Summer Heat Transfer Conference and actually my first time in the U.S. The conference was extremely rich and well organized. I really enjoyed presenting my work, but it was even more important to attend presentations from the experts in different fields and also to meet colleagues and make new friends.

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COMPETENCY DEVELOPMENT IN SUPPORT OF ENGINEERING PROFESSIONAL PRACTICE

by Franz-Josef Kahlen of the University of Cape Town, S. Africa, Shannon Flumerfelt of Oakland University, USA, Anabela C. Alves of the University of Minho, Portugal, and Anna Bella Siriban Manalang of De La Salle University, Philippines.

If you were to enter a room of practicing engineers and ask them about e.g. Just-in-Time, Continuous Improvement, Problem Solving or Systems Thinking, virtually everyone would tell you that these terms show up at least weekly in their discussions, project motivations, general complaints from their fellow staff, and directives from their top management. If you were to ask further about the origin of these keywords and tools, a smaller percentage would likely be able to correctly place them with Lean Engineering. Now, if you were to ask how many of the practicing engineers have been taught by their university instructors using such tools, no hands would show. It is a startling, yet at the same time sobering realization that, although Lean Engineering has been known outside Japan for many decades, the very same tools and principles that made Lean Engineering so successful in the workplace have still not made it into the way we educate engineers today.

Coming from a different angle, ASME in 2009 launched the domestic field study "Vision 2030" about the strengths and weaknesses of engineering programs today. The field study is based on the participation of a large number of academics, entry-level hiring managers, and early career engineers. ASME's Vision 2030 showed that existing project management, systems thinking, communications, team work, and problem solving skills and competencies fall short significantly of what is required in the workplace. What is making it into the ASME mainstream now is the recognition that the engineering content is strong in engineering graduates. But the engineering professional practice and competencies must be considered weak.

If these shortfalls already exist today, how will engineers cope with the workplace demand of engineers in the year 2030, just over 15 years into the future? The challenges facing humanity on this planet are known today and are summarized in the Millennium Development Goals (see Figure 1). Addressing these challenges requires technical expertise combined with the aforementioned competencies and skills which are frighteningly absent in large cohorts of today's engineering graduates.

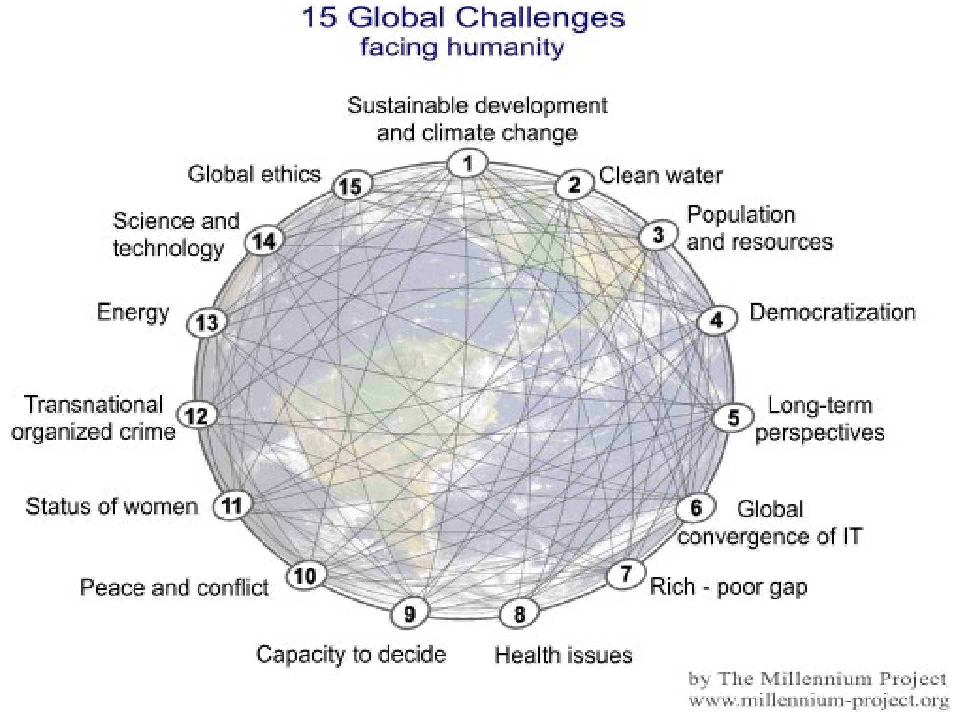

Figure: Millennium Development Goals

A call for a participation from Franz-Josef Kahlen in the panel on "Global Experiences in Operations and Lean Engineering Education", under the Workforce Development Track at IMECE 2010 in Vancouver, BC was the beginning of a journey for four participants without an end in sight: Franz-Josef Kahlen (Mechanical Engineering, University of Cape Town, South Africa), Shannon Flumerfelt (Social Sciences, Oakland University, USA), Anabela C. Alves (Industrial Engineering, University of Minho, Portugal) and Anna-Bella Siriban-Manalang (Industrial Engineering, De La Salle University, Philippines) began to pool their teaching experiences and frustrations, as well as passions about Lean Engineering, and raised the questions: If Lean Engineering Education existed, what could it do for us? What would it even look like? And most importantly: Would it address the hidden as well as the sometimes glaringly obvious shortcomings of current engineering education which ASME's Vision 2030 had uncovered?

At every IMECE since 2010, and at the International Leadership Summit on Mechanical/Multi-disciplinary Engineering Education (2011) in Hong Kong, we have presented about Lean Engineering Education. 'Lean' requires the focus on the purpose of an organization, the development of processes to deliver against said purpose, and the workforce development (people) to actually implement and operate in these processes. Born out of the need to be resource-efficient in a resource-starved Japan after World War II, it was mission-critical to only produce products that the markets would absorb, at a time when the market was demanding such products, while not creating waste in the process. This unequivocally implies a strong focus on systems thinking, problem solving, communication, and project management competencies – which are just the competencies that Vision 2030 identified as critically absent in many graduating engineers.

Our IMECE papers include studies about the need for a strong ethics foundation in mechanical engineering, the development of systems thinking competencies on top of a strong ethical foundation, and the sustainability as a success measure of successful systems thinking. Several times, we have likened this triad to heart (ethics), head (systems thinking) and hands (sustainability). The next step for us is to publish our Lean Engineering Education concept in a book through ASME Press. The book is intended to inform the debate around Vision 2030 and to interpret the gathered data from a lean and operations engineering perspective by several practitioners in the field, coming from engineering and social sciences disciplines. It will further address the question of what a mechanical engineer must be able to do in 2030 that he cannot do today. Ultimately, this book is intended to stimulate the debate about Vision 2030 in the mainstream of the society and invite discourse about how engineering education incorporates issues such as professional practice and sustainability.

In many ways, we as the authors are grateful for the opportunity to share our work with the readers of this newsletter. The biggest accomplishment for us would be to start a debate among practitioners about the evolution of our own profession. It is as noteworthy as it is saddening to realize that there is no platform or forum within ASME, to discuss the developments and the demands placed on mechanical engineering, and how it needs to transform into a useful blend of content and competencies. And while we firmly believe that Lean Engineering Education is one avenue of transforming mechanical engineering education, we do not believe that there is only this one way how to bring content and competency together. Therefore, we definitely want to hear about your approaches, suggestions, and your own engineering professional practice.

WRITING ARTICLES FOR RESEARCH JOURNALS

by Ritesh Lakhkar and Derek Reding, Originally Published in ASME's Early Career E-Magazine *ME Today* (https://www.asme.org/career-education/early-career-engineers/me-today)

Many undergraduate students pursue higher studies such as a masters or a doctorate degree in their field of interest, but when it comes to publishing their research in the form of a journal article, many struggle to get through their first attempts. To provide some guidance for early career engineers and researchers entering graduate school or pursuing an interest of writing a journal article, we offer the following information on how to go about writing an article for research journals.

Publishing Starts with Research---Journal articles are supposed to contain original research – the more important the topic the better. There are two main types of research, namely basic and applied. Basic research is focused on fundamental knowledge in a field. In contrast, applied research is focused on applying fundamental knowledge towards a novel approach or methodology. It is important to realize that research is the activity of investigating new approaches to problems where an adequate approach is lacking, basic or applied.

Meaningful research is directed towards important problems. These are problems in which advancement will be of significant benefit in terms of application and/or theoretical developments. Research involves answering two questions, viz., 1) is the proposed approach new, and 2) is this approach better than all other approaches?

The description for what constitutes research is only briefly discussed here since the focus is on writing a journal article. Assuming that one is engaged in research, the corresponding journal article is a formality for all practical purposes.

Motivation to Publish---Research can be performed without writing journal articles. However, this is not common due to the incentives for publishing in peer-reviewed journals. Motivation to publish should be clear. One possibility is to secure a new idea in the pool of knowledge. Although this motivation is idealistic, it is often not the only one.

Another motivation is to gain professional credibility. Researchers need to realize that they don't need to publish many journal articles to become credible, but more can certainly help. Publishing journal articles helps to secure research positions, especially for early career researchers. These positions are typically found in Universities and Research Laboratories.

Industry generally has very limited time to solve problems, thus, research is very difficult and projects usually become advanced engineering initiatives instead of research initiatives. Patents play a vital role as compared to journal publications when it comes to advanced engineering in the industry. Many times, it may not be possible to publish advanced engineering research in a journal publication, or even in a patent, due to proprietary reasons.

To secure a research position such as research scientist or professor, one needs to publish as much of their research as possible. It should be known that only one good article is needed to cement a position in a research circle. Nobody can afford a bad article or one that has false claims or incorrect information, so it may be important to shelf papers that do not meet the highest standards. This happens to all researchers because some ideas just don't work.

Two General Approaches---There are a few main routes one may take towards publishing a journal article. The easiest and most common approach is to present research at conferences before compiling the completed work in a journal article draft. This may be referred to as the "feedback approach". There are serious advantages to this approach. First, one is able to get valuable feedback on their proposed approach from the research community. This feedback can be in the form of questions at the end of a presentation, private discussions, and collaboration. Second, conferences act as intermediate deadlines to aim for during one's research activities. This is possible because conferences do not require completed work like journals do, so one may present at a few conferences before writing the completed journal article.

Another approach is what can be called a "direct approach". This approach involves journal writing activity from the outset of a research project. This approach may be a bit more risky since it does not necessarily involve feedback from peers at conference proceedings. Generally, this approach works best for intermediate and advanced researchers – not beginners unless they are well-advised or unusually gifted. Moreover, this approach works especially well for those who have already published a peer-reviewed journal article.

What is a Journal Article?---A journal article is a peer-reviewed report that contains an original and complete research study. These articles present a new approach towards solving a problem. Fortunately, there are many examples in the literature, but not all articles are ideal. A model article is one that has i) a clear and concise problem identification, ii) a clear and concise proposed approach or thesis, and iii) sufficient evidence to support their approach or thesis. The layout begins with an abstract, which articulates a brief summary of all three of these aspects. This is followed by an introduction and/or background section, in which the topic scope is identified, motivation is provided, and relevant previous works are summarized in the context of the current work. The body sections divide up the topic into simple and tractable bodies that provide all required information, or references that contain information required to reproduce the results of the research. Findings must sufficiently support the claims made in the article. Finally, a conclusions section is used to give short statement of the findings and claims that are clearly reached as a result of the research. This is not a summary. All discussions should be included in the main body of the article, with the exception of appendices. An appendix is simply a collection of supplementary material that cannot be found in a reference but would otherwise overly-complicate or detract from the readability of the article. Footnotes are useful for stating information that is too brief for an appendix.

Some Preliminaries---In either the feedback approach or the direct approach, described above, research should be initiated by identifying the problem that is to be solved. This will help to identify the scope of the article. Once a scope is identified, to some extent, one then begins to review relevant literature including books, conference articles, and journal articles. The literature review helps to identify the journal that one will want to eventually publish in.

During journal writing, and during research activities, one should pay some attention to the rank of the journals as these are read. Some journals permit much longer articles than others. Some journals such as the ones related to theoretical or applied physics have a specific focus. The activity of reading relevant articles on one's research topic will help one to find the most appropriate journal for publishing their work.

Some journals are regarded as better than others, but there are several ranking methods to choose from. Two typical methods are 1) article influence (AI) and 2) Eigenfactor. A good discussion of these methodologies is provided at www.eigenfactor.org. Another important factor that will influence one's choice of journal is the publishing costs, which may be covered by a research grant.

An important consideration to keep in mind early in the process is if there will be collaboration. One must identify who should be involved as a possible co-author. An adviser or mentor is the most obvious co-author for early career researchers. It is sometimes difficult to know who is a contributor towards the content of your article. For example, a technician who helps you to perform experiments may or may not become a co-author. The important thing to know is that one should discuss co-authorship possibilities with all those who are engaged in any part of the research activities.

General Strategy---The general strategy for writing a journal article is to start by writing a rough abstract. The abstract may very well be totally scrapped a few times during the research process, but this activity can help one to organize their thoughts. It can be helpful to write a "working draft", or an incomplete draft of the article, which is usually heavy on the introduction and relevant background. Some researchers even write a separate document with a detailed literature review in which each article is summarized in the context of their research. This "working draft" can also be useful for containing preliminary results and tables that one plans to fill in with the results. In a way, the article can take a shape holistically by becoming an integral part of one's research effort. Moreover, as the research comes to a close, one will not have far to reach towards finalizing the article. In the feedback approach described above, this integral report writing or "working draft" can be in the format of conference articles. Generally, it is best to publish in a journal that is tied to the conference in which one presents any of the relevant results. This means that no matter which approach is taken towards writing one's article, it is a good idea to know what conferences and corresponding journals are of most interest.

The last stage in writing a journal article is making sure that the research is complete. Reaching depth is important – not breadth. Determining adequate depth brings back the aforementioned two questions regarding the nature of research, namely 1) is the proposed approach new, and 2) is this approach better than all other approaches? If one can clearly and undeniably answer "yes" to both questions, then the final stages in writing one's article are merely a formality. Still, one may wish to enlist the help of a colleague for final review of their manuscript.

During the final stages, one needs to include an acknowledgments section after the conclusions. This section gives recognition to funding agencies and to those all whose help was significant, but not enough for co-authorship.

There is the possibility that one may find that their approach reaches a fork in the road. It is not uncommon for a proposed approach to be radically different enough from previous approaches that the theoretical or experimental underpinnings do not exist yet. This is a good time to consider splitting the research into two or more papers.

Support---Research and publishing, early in one's research career, almost always involves some form of support. The help of a research mentor is invaluable. It is important to choose wisely because not all individuals in a research position are doing real research. This is in no way meant to offend those who are in a faculty or research scientist position. Many of these individuals make important and valuable contributions, but not always in research. There can be a fine line between real research and advanced engineering. It is important to know the difference in advance. A research mentor can help when attempting to know this difference.

The other form of support is financial. Having enough money is very important when attempting to engage in research activities. Money buys equipment, time, and help from others. Usually financial support for conducting research activities is provided by the universities, the government research organizations, or at times by the industry.

NOTABLE PID HIGHLIGHTS

IMECE 2013 PID BEST PAPER AWARD - ABSTRACT

INVESTIGATION OF AIRFLOW COOLING OF LI-ION BATTERIES

Alexey Lukhanin, Andrey Byelyayev, Dmitrij Fedorchenko, Manap Khazhmuradov, Oleksandr Lukhanin Sergey Martynov, Yegor Rudychev, Eugene Sporov
Kharkov institute of physics and technology, Kharkov, Ukraine
Upendra S. Rohatgi
Brookhaven National Laboratory, Ridge, NY, USA
IMECE2013-63095

Lithium -ion batteries are used in electric cars, hybrid cars and Boeing 787 Dreamliner. There is an issue with heat generation in these batteries that may cause fire and reduce performance.

An experimental chamber has been setup that provides dynamic and static cooling/heating regimes for Li-ion batteries. Air flow is produced by air station with maximum output of 80m^3/h. The maximum possible pressure drop is 7000 Pa. Air station can work both in pumping and exhausting mode. This test setup will be used to study various surface topology to enhance heat transfer without increase weight.

Figure: Dr. Rohtagi is presented with the award by Subha and Florin

Experimental setup contains two-stage temperature stabilization system. During the first stage we use the preliminary heating or cooling of the inlet air in the air buffer. The aim is to achieve the air temperature close to required inlet temperature. During the next stage air passes through the chamber with temperature controller where eventually the flow temperature is set. This approach provides flow temperature stabilization within -30^{o}Cto +50^{o}C range with 0.2^{o}C accuracy.

For our studies we have designed and manufactured simulators of Li-ion battery power cells with the same thermal properties as the original ones. Each simulator contains 40 surface temperature sensors (20 per side). The data from sensors is transferred to computer by the NI-6225 PC card for control and further processing. The design of the simulators provides information about the placement of cooling surfaces with various surface elements and its efficiency –fins, triangles, wings, etc.

In this paper, the characteristics of cooling surfaces with filleted pins will be reported. We have measured the surface temperature distributions and obtained the corresponding cooling diagrams for 10 – 40^{o}C temperature range and 1m/sec - 4m/sec flow rates. The experimental results are compared to the computer simulation using SolidWorks Flow Simulation™ software.

IMECE 2012 PID BEST PAPER AWARD - ABSTRACT

BRIDGING ACADEMIA AND INDUSTRY GAP, THROUGH GLOBAL COMPETENCIES: INDUSTRIAL OUTREACH PROGRAM US-MEXICO

Victor H. Mucino, Elisabeth Sanchez-Goni
West Virginia University, Morgantown, WV
Alejandro A. Lozano Guzmán, Israel Aguilera Navarrete
Instituto Politécnico Nacional, Santiago de Querétaro, QUE, México
Edna Karina Alcázar Farías
Universidad Autonoma de Querétaro, Santiago de Querétaro, QUE, México
IMECE2012-86444


Figure: Mr. Navarrete is presented with the award by Subha and Florin

Global competencies of engineering graduates have been identified as traits that are increasingly necessary for professional competitiveness of graduates, but continue to be elusive and difficult to address in the engineering curricula. Study abroad and experiential learning programs have been invoked to address some of the global competencies with varied degrees of success. In this paper, a faculty-led program model developed by West Virginia University and several institutions in Mexico and the US is presented, in which senior engineering students from the US and Mexico team up to conduct meaningful engineering projects in industry in Mexico. Intermixed teams of students are formed and placed in various industrial sites to work full time under the advice of engineering practitioners and faculty members from both Mexico and USA. Global competencies are addressed in the context of a project that requires students to work with peers of similar disciplines and level across language and cultural barriers.

SPECIAL ANNOUNCEMENT

2014 CITRUS ENGINEERING CONFERENCE

The Citrus Engineering Conference was started by Florida Section Chair Andy Hines in 1954 to promote exchange of information in the citrus processing industry. The Conference has maintained its ties with the Florida Section ever since but has operated independently. Recently, with the approval of the ASME organization, the CEC has become its own chapter under the Process Engineering Division.

The Citrus Engineering Conference has been traditionally held each March during the lull portion of the citrus season. The conference is always held at the Ben Hill Griffin Jr. Citrus Hall, Citrus Research and Education Center, Lake Alfred, Florida. The conference is one day, with 4 presentations in the morning and 2 to 4 in the afternoon, with lunch in between. Attendees are drawn from a mailing list of over 250 employees of the Citrus Industry across Florida and even South America. Attendance is typically 80 to 120+. Topics of the conference are varied and have included energy saving techniques, mechanical harvesting, improvements in extraction of oils and juice, trends in ammonia refrigeration, and filtration improvements. A complete list of past topics can be found at: http://www.asme-florida.org/list_of_transactions.htm

The conference provides a means for engineers and scientists in the Citrus Industry to share knowledge as well as develop personal relationships during breaks and the luncheon. The CEC committee has also awarded scholarships in honor of the Citrus Engineer of the Year. The award has been sponsored by Progress Energy.

In 2012, the conference committee decided to hold the conference every 2 years. In addition, a member could present their findings without having to submit a formal paper. This allows representatives of the industry to share their knowledge without compromising their companies Intellectual Property limitations.

This year, the conference committee has decided to hold the conference on June 12th. This will allow them to gather a forum of individuals to discuss the impact of a citrus greening disease that has greatly impacted production in Florida. The citrus process has had to adjust to this lower availability of product and its impact on the size and content of the fruit.

For more information, contact Jim Stana (stanaj@asme.org) or Elizabeth Webb (Elizabeth.Webb@brown-intl.com)

PID Technical Committees

ASME Process Industries Division is constantly seeking the active and motivated ASME members to participate in Division professional activities and technical programming of the PID-sponsored events. At this time PID has four technical committees:

- **Water Technology and Sustainability**

Aim is to develop new ideas, exchange technical information and experiences in the treatment of water for the process industries. Major interests are: advanced membrane development; desalination, distillation and reverse osmosis; application of nanotechnology (nanotubes and nanoparticles) for water treatment; water conditioning for specific industrial and commercial processes; cooling water treatment; cooling water system maintenance; corrosion control; water purification; water quality guidelines, wastewater treatment and water reuse and concentrate disposal.

Chairman: Raj Manglik

- **Compressor Technology**

Strives to foster the development/dissemination of knowledge specific to state-of-the-art and future technologies and advanced trouble-shooting techniques related to turbomachinery for applications in petrochemical and fertilizer plants, refineries, steel mills, air separation plants, refrigeration systems and natural gas stations. Topical interests are in innovative compressor concepts, aero- and rotor-dynamic solutions, bearing and seal design as well as maintenance and failure prediction.

Chairman: Guy Phuong

- **Heat and Mass Transfer Systems**

Concerned with design, performance and application of heat transfer equipment of particular interest to the process and cryogenic industries. Current interest includes innovations for heat and mass transfer enhancement, energy efficiency improvement, degradation due to corrosion and oxides, cleaning and decontaminating heat exchangers and process heat integration in the process and cryogenics heat exchanger equipment.

Chairman: Hal Strumpf

- **Engineering Education**

Approaches various pedagogy and curriculum development issues in mechanical engineering. Specific topics involve incorporating modern technology and tools, societal and ethical dimensions of engineering, globalization, distance learning, school and industry alliance, and precollege (K-12) STEM. It also deals with innovative methods in teaching and learning of contemporary topics involving sustainable and green engineering as well as traditional topics (e.g., heat transfer, fluid mechanics, solid).

Chairman: Subha Kumpaty

Process Industries Division (PID)

Three Park Avenue
New York, NY
10016-5990 U.S.A.

PROCESS INDUSTRIES DIVISION EXECUTIVE COMMITTEE

PROCESS INDUSTRIES DIVISION 2013-2014
EXECUTIVE COMMITTEE

CHAIR **Florin Iancu, Ph.D.** TURBOdesign Technology, Inc. 80 Broad Street, 5th Fl. New York, NY 10004 Phone: (240) 515-6429 Email: f.iancu@turbodesign-tech.com	**SECRETYARY/TREASURER** **Srinivasa Jeyakumar, PE** P.O.Box 2844 150- 6Ave SW Calgary AB T2P 3E3 Phone: (780) 790-4803 Email: sjeyakumar@suncor.com	**COMMUNICATIONS OFFICER** **Paul Glanville, PE** Gas Technology Institute 1700 S Mount Prospect Rd Des Plaines, IL 60018 Phone: (847) 768-0782 Email: paulglanville@asme.org
VICE CHAIR **Tiruvadi S. Ravigururajan, PE** Wichita State Univ; Mech. Eng. Dept. Campus Box 133 Wichita, KS 67260-0001 Phone: (316)978-3402 Email: ts.ravi@wichita.edu	**PROGRAM CHAIR** **Qubo Li Ph.D.** FMC Technologies 5875 N. Sam Houston Pkwy Houston, TX 77086 Phone: (517) 899-0759 Email: Qubo.Li@fmcti.com	**MEMBER-AT-LARGE** **Guy Phuong** Daikin McQuay International 13600 Industrial Park Blvd Minneapolis, MN 55441 Phone: (763) 553-5300 Email: Guy.Phuong@daikinmcquay.com