

Serving Society by improving Engineering Education
through **Reform** and **Diversity**.



SEFI is the largest network of engineering education institutions
and engineering stakeholders in Europe.

"The passion for engineering education."



45th Anniversary of SEFI

2018 Annual Conference of European Society for Engineering Education (SEFI) Creativity, Innovation and Entrepreneurship for Engineering Education Excellence

Technical University of Denmark ([DTU](http://www.dtu.dk)) , Copenhagen

18-21 September 2018

Innovation and entrepreneurship has recently become more and more dominant in engineering education. To focus more on careers as start-up entrepreneurs than corporate or industrial careers is a mega-trend with growing groups engineering students. The theme of this conference is how creativity, innovation and entrepreneurship obviously must be *new content* of the engineering curriculum – but also how it can serve as a *perfect context* for teaching and learning engineering generally.

The focus of SEFI conferences is Engineering Education, including all its aspects. Authors are encouraged to link their contributions to the conference theme 2018 “Creativity, Innovation and Entrepreneurship for Engineering Education Excellence”. The conference language is English. All accepted papers will be referenced in SCOPUS.

Conference sub-themes include but are not limited to

- Continuing Engineering Education and Lifelong Learning
- Curriculum Development
- Discipline-specific Teaching and Learning in Engineering Education
- Educational and Organisational Development
- Engineering Education Research
- Ethics in Engineering Education
- Gender and Diversity
- Innovative Teaching and Learning Methods in EE
- Open and Online Engineering Education
- Quality Assurance and Accreditation
- Recruitment and Retention of students
- Supervision of larger projects in Engineering Education (e.g. PhD)
- Sustainability in Engineering Education
- Teaching and Learning Facilities and Spaces
 - supporting innovative T&L methods
- University-Business cooperation
- Engineering Skills

Provisional deadlines:

Abstract submission	4 March 2018
Full paper submission	1 May 2018
Final paper submission	6 August 2018
Early Bird registration	10 July 2018

Please find further information on www.sefi2018.eu or contact sefi2018@dtu.dk
We look forward to welcoming you to the Technical University of Denmark in September 2018!

Message from the President and the President-elect

After several dark years for Europe, we are still facing turmoil and uncertainty, but thankfully Europe is not falling completely apart. This academic year seems more politically stable although populism and separatism continuously threaten to split the European countries rather than uniting its people. SEFI is for European collaboration and integration, and we are ready to serve all the European societies through the part we play in engineering education.

SEFI is a diverse community linked by a shared mission to contribute to the development and improvement of engineering education in Europe. While there is diversity in our membership, we fundamentally believe that this diversity gives us strength in addressing our shared mission. To engineers, diversity has always been and will always be a source of inspiration, creativity and innovation. Our strong network shows clearly when looking at the *SEFI membership*: Institutional members embrace *educators, professors and management* from universities, schools, and other higher education institutions of engineering from across Europe, Central Asia and the Middle East. Personal members are *individuals* with a special interest in engineering education from all over the world. You do not have to be European to be a member of SEFI, and to contribute to the activities of our society! Associate members cover an international range of influential and important *organisations*, including student societies, from Europe, Australasia, the Americas, Eastern and Southeast Asia, Africa and the Middle East. Corporate members are *industries and companies* contributing in particular with support from and contact to the (real) world. Our *honorary members* complete the list. SEFI will continue to focus on delivering tangible value to our existing members, and we will also continue to attract new members to share and to contribute to this value.

It is our responsibility to educate: to facilitate learning and the acquisition of engineering knowledge, skills, and competences. As engineering educators, we intrinsically believe that we improve society through our endeavor to improve engineering education, and consequently the work of our graduates when they embark on their careers. But to improve engineering education it is important to realise that *engineering education must constantly change and undergo reforms*: the world is constantly changing, and with it the needs of society for engineers and the skills and competences they must master. Young people whom we want to attract to engineering studies change from generation to generation - as well as the way they live and learn, and what they find interesting and challenging in life. Finally, our own "tool box" for teaching and learning is in the midst of a revolution, and our interaction with student engineers spans a range from good old-fashioned once-a-week "chalk and talk" lectures to interactive flipped classroom sessions in cyberspace with immediate and individualised feed-back. Surely, engineering education must therefore constantly change and undergo reforms.

We fundamentally believe that engineering education is vital and essential to society. By improving, through our community of activities, how student engineers are educated, and through that education, the attributes that they possess as graduates, we are delivering value and benefits to society. In order to continuously improve our efforts we listed four Priority Themes in 2015 in our *strategy "SEFI towards 2020"*:

- Attractiveness of engineering education
- Employability in terms of the preparation of our graduates
- Capacity building through a focus on mobility, accreditation, quality, and digital technologies
- Engineering education as a coherent and relevant field of research

These themes remain and are acted upon and developed through our Working Groups and Task Forces, the SEFI Annual Conference, our publications – especially the European Journal of Engineering Education, our Position Papers, the SEFI debates, the ECED - European Convention for Engineering Deans, and involvement in EU projects.

This year we have decided to reshape our *Maffioli Award* in order to give attractiveness of engineering education a boost – for all those fine women and men who teach and educate student engineers. It is important to celebrate the good quality of innovative activities, where engineering teaching and learning is developed and improved in relation to didactics and pedagogical approach. Our ambition is to make the Maffioli Award the *European Cup of the development of engineering teaching and learning*. We would like to see nominees from all engineering schools and universities, to celebrate their combined

efforts and in particular appoint a winner via open and transparent criteria.

Employability of our student engineers and *capacity building* of our education programmes go hand in hand. The SEFI initiated regional event "International Seminar on Mechatronics 4.0" is an example of this and also a successful example on how our diverse community facilitates interaction and collaboration amongst corporate and academic institutional members of SEFI. Internet of Things, digitalization, industry 4.0, cyber physical systems and mechatronics all refer to a meta trend that is fundamentally changing the way companies develop products, operate systems and offer services. These terms touch upon all disciplines of engineering and resonate broadly outside engineering in the political spectrum, branch organisations, commerce, business, and education. The big question is how we can adapt and generally educate engineers to also possess the interdisciplinary skillsets needed to conceive, design, implement and operate the multitude of products, processes and systems that the Internet of Things make possible.

One part of the SEFI strategy still needs attention. *Engineering Education Research* is an active field in SEFI where educational researchers meet with education practitioners and scholars. However it is a field, where very little research funding is available. One can judge a society on how it takes care of the education of its young citizens. Here, engineering education is not receiving the attention it deserves. Huge potential lies in researching into and developing the teaching and learning of engineering, and European countries have an opportunity to make substantial progress in research into engineering education. This must be put on the agenda of the EU in order to make resources available in this very important area.

A year has passed by and it is important for us to thank the people and organisations who have helped and contributed to the activities of SEFI. This is a long list and covers persons from universities, institutions and companies, where we have held meetings, had our SEFI Annual Conference and the European Convention for Engineering Deans. We thank the organisations with whom we have had close collaboration in various projects. We thank student organisations and individuals for the contact and dialogue we have had with them. We thank our sponsors for their substantial support – not only financial but certainly also in terms of their time and personal devotion. Finally, we both feel grateful to those special individuals from inside our own ranks of SEFI who contribute to our community above and beyond the normal call of duty. They know themselves who they are – and so do we. They are very special and valuable individuals: thank you!

We live in troublesome times. Now more than ever it is important that we continue to support the recognition of engineering awards and diplomas, the mobility of engineers and the value of (EU) programmes, which are designed to encourage and support mobility and cooperation internationally. We are committed to developing and participating in trans-national networks that also support these aims. SEFI is indeed a society dedicated to collaboration and exchange in engineering education across borders, be those borders culture, ethnicity, gender, geography, nationality or religion, and we are also determined in our belief that education is the best "weapon" for a long-term peaceful society - for Europe and for the rest of the world.



Professor Martin E. Vigild

28th President of SEFI 2015-2017
Technical University of Denmark



Professor Mike Murphy

President-Elect of SEFI
Dublin Institute of Technology

2015-2016 Highlights

SEFI Annual Conference 2016 in Tampere



The Conference brought together a wide variety of engineering education stakeholders from Europe and beyond. More than **300 participants from 32 countries** met in the University of Tampere for the 44th SEFI Annual conference. More than **150 papers** were presented in the course of **8 parallel sessions** covering the theme of the conference **Engineering Education on Top of the World: Industry University Cooperation** and structured around different sub-topics such as University-Business cooperation; Engineering Skills; Sustainability and Engineering Education; Quality Assurance and Accreditation; Continuing Engineering Education and Life-long Learning; Open and Online Engineering Education; Ethics in Engineering Education; Curriculum Development; Attractiveness of Engineering Education; Physics and Engineering Education; Engineering Education Research; Gender and Diversity; and "I feel brilliant". The papers, available on SEFI website (Proceedings) are also indexed on Scopus.

Keynote presentations were given by **Dr. Mervyn Jones** *Imperial College* (UK) on "Engineering, Industry and Education: A Personal Perspective", by **Prof. Gary Downey** *Virginia Tech* (US) on "Leading through Technical Mediation? Engineering as Problem Definition and Solution", by **Aldert Kamp**, *TU Delft* (NL) entitled "Better make It Real" and **Ville Korpiluoto** on "Demola – Building Innovation Culture".

Another highlight has been our University-Business Plenary Round Table, chaired by **Mr. Xavier Fouger**, *Dassault Systèmes* and Member of the *SEFI Board of Directors*, with the participation of our corporate partners representatives: **Mark Fry**, *Granta Design*, **Alex Tarchini**, *Mathworks*, as well as **Michel Haddad**, *National Instrument*. This year the round-table was on the theme of **New Skills for New Jobs-New Tools for New Skills**.

Every year, we see an increase in the number of **workshops** and meetings organised for the SEFI annual conference participants. This year, our participants were offered to take part in **two satellite events**, the *First SEFI Doctoral Consortium* and the *Online Learning in Engineering Education Hands on Workshop*. The workshops of European Projects **ReadySTEMgo**, **STELA** as well as **EPICES** (*three projects of which SEFI is a partner*) were organised too. Furthermore, a variety of workshops were offered by the **SEFI Working groups**: *Transfer of Engineering Education to Academic Curriculum* by WGs Curriculum Development and Open and Online Engineering Education; *Exploring Pedagogic Frailty in Engineering Education: What's holding us back? What are some tangible actions?* by WG Ethics in Engineering Education; *Can autonomous vehicles change traditional gender stereotypes?* by WG Gender and Diversity in Engineering Education; *STEAMing Ahead! A Paradigm Shift in Research & Rhetoric: [Enhancing the student experience through Active Learning & Educational Research]* by WG Engineering Education Research as well as a workshop organised by the WG Sustainability in Engineering Education. Our Corporate Partner and Conference Sponsor, **Mathworks**, also offered well attended hands-on workshop. As a result the first Call for Workshops in a SEFI Conference participants could also participate to the following workshops: *Hands on Workshop on Teaching Forensic Engineering - Teaching Students Critical Thinking by Investigative mindset*; *Integrating international degree students into the academic culture - workshop to benchmark best practices*; *Engineers' competence building for innovation*; and the workshop *Innovating Engineering Education - the Perspective of Three Universities of Technology in the Netherlands*.

Our thanks go to all those who have contributed to make this 44th conference a huge success, and especially the conference Chair, Prof. Hannu-Matti Järvinen. The conference was made possible thanks to the support of our sponsors

Leonardo da Vinci Medalist 2016

The Leonardo da Vinci medal is the highest distinction SEFI can bestow to award persons who have made an outstanding contribution of international significance to engineering education. Since its institution in 1983 it has been awarded to prestigious personalities from the world.. This year, the Medal was given to another exceptional person, **Markku Markkula** from Finland, former member of the Finnish Parliament, Director of the center for CEE in Dipoli, Adviser to the Rector of Aalto University, and President of the EU Committee of the Regions . Markku has also been director of the TEK in Finland and held senior positions in international organisations such as IACEE and SEFI. In SEFI he notably chaired our WG on CEE and LLL and is the author of books published in cooperation with SEFI such as "European CEE: conceptualising the lessons learned", "The Knowledge Triangle, Re-inventing the future".



Fellowships 2016

This year, the Board of Directors of SEFI had decided to award SEFI fellowship to two highly dedicated members of our society.



Prof. Wim Van Petegem (KU Leuven, Faculty of Engineering Technology, BE). former President of SEFI for the period of 2011-2013, Wim has been for many years very actively involved in different university cooperation networks (and of course SEFI). During Wim' Presidency was notably celebrated our 40th anniversary and the memorable Leuven 2013 Conference. He was also one of the promoters of the SEFI Values, values for which the Society stands and around which it evolves.



Prof. Burkhard Alpers (Aalen University of Applied Sciences, Dept of Mechanical Engineering, DE). Burkhard was a very active member of the SEFI WG on Mathematics, and became its Chairman in 2008. During Prof. Alpers' chairmanship the group notably published a new version of the famous report "*A Framework for Mathematics Curricula in Engineering Education*".

General Assembly 2016

The General Assembly 2016 met on 14 September in Tampere. Amongst the statutory decisions taken by the GA, the modifications of the SEFI statutes and bylaws were approved as well as the strategy for the future of our EJEE. The strategy paper 2015-2020 and our Action plan 2015-2017 were also discussed.

The members also unanimously approved the nomination of **Prof. Mike Murphy**, Director, Digital Campus & Learning Transformation, Dublin Institute of Technology (IE) as SEFI Vice-President 2016-2017, President 2017-2019.

The Assembly also elected for a second mandate three-year mandate within the Board of Directors, **Dr. Pieter de Vries** (Delft TU, NL) and **Prof. HM Järvinen** (Tampere UT, FIN). They elected for a first three-year mandate **Dr. Neil Cooke** (University of Birmingham, UK), **Dr. Fredrik Georgsson** (Umea University, S), **Dr. Seweryn Spalek** (Silesian University, PL) and for one year, **Prof. Carlos Rioja del Rio**, University of Cadiz (E).

The President thanked for their dedication the outgoing Board members in the persons of Profs. Moropoulou (Vice President 2013-2016), NTUA, GR), Musilek (Czech TU in Prague, CZ), Alpay (University of Surrey, UK) and Rutkowski (Silesian UT, PL).

Prof. Jonte Bernhard from Linköping University (S) was nominated as acting Chair for the WG on Engineering Education Research, Prof. Manfred Hampe (TU Darsmtadt, DE) was appointed as acting Chair of the WG on Ethics whilst Prof. Murphy was confirmed in his capacity of Chair of the SEFI European Council for Engineering Deans (EEDC). The Assembly was also the occasion for President Vigild (DTU, DK) to present his annual report to the members, and in this context, he notably emphasised the cooperation with our partner organisations in Europe and in the world, with a special mention of our successful 2016 Convention for Engineering Deans (ECED), organised this year again with our partner CESAER, and hosted by the University College London. His special thanks went to Prof. John Mitchell for the splendid organisation of ECED 2016. Further to the Convention was published the SEFI/UCL so-called [London Agenda](#), which lists the most important challenges and opportunities for European Engineering Schools today.

Extraordinary General Assembly was organized on 4 April 2017 in order to ratify the statutory decisions made in Tampere.

European Convention for Engineering Deans—The Munich Message



80 deans, directors, head of departments met together at the 9th **European Convention of Engineering Deans** jointly organised by SEFI and CESAER and this year in cooperation with TU Munich (3-4 April 2017). It was the 9th convention for European deans that was organised by SEFI since 2005, and in cooperation with CESAER since 2011. Previous conventions were organised in Florence in 2005, Berlin in 2008, Paris in 2011, Birmingham in 2012, Aalborg in 2013, Lund in 2014, Valencia in 2015 (Outcome "[Valencia Vision](#)") and London in 2016 (Outcome: SEFI/UCL "[London Agenda](#)").

The participants discussed and exchanged about the three major topics of research, education and governance. The first topic asked the question whether departmental borders are prohibitive for crossing boundaries and whether we appraise professors the best way with the current metric system. The second topic was related to accreditation and recognition, and to diversity of curricula as an asset or a way to hinder recognition and meaningful comparison of engineering degrees. We discussed what to actually compare and to what extent does accreditation and any possible common frameworks contribute to improving the quality of EE and to what extent they limit innovation in curricula and pedagogy. The third topic dealt with the type of leadership that is needed in universities to support new streams of research and innovations in education, and what

competences does modern university management require to be resilient and to cope with the complexity of the today academic environment. YouTube videos had been prepared by representatives from academia, student organisations and employers from different parts of Europe and further to the invited plenary presentations given by **Jan Gulliksen**, KTH, **Marianne Thellersen**, DTU, **Bernard Remaud**, ENAEE, **Sophie Weisswange**, European Commission, **Karel Luyben**, TU Delft and **Mike Hounslow**, University of Sheffield; panelists **David Fitzpatrick**, University College Dublin, **João Falcão e Cunha**, University of Porto, **Dave Wilson**, National Instruments, **Alex Tarchini**, MathWorks, **Rudolf F. Schwarz**, IABG mbH, **Zbynek Skvor**, Czech Technical University in Prague, **Francesc Gine de Sola**, University of Lleida, **Alexia Spyridonidou**, BEST (Board of European Students in Technology), **Peter Kilpatrick**, GEDC and University Notre-Dame, **Hans-Joachim Bargstädt**, President 4ING, **Natacha DePaola**, GEDC and Illinois Institute of Technology, **János Levendovszky**, BME, had also been invited to debate on these challenging topics. The YouTube videos and the presentations can be seen on www.eced2017.com. The final session concentrated on summing up the **Munich Statements** about Education, Research and Governance that will soon be described into the "[Munich Message](#)" to be published in the coming months as a joint SEFI, CESAER and TU Munich document..

The 2018 ECED will be organised by NTNU in Trondheim (N) in May 2018 where the Munich Message statements will be elaborated and developed into strategic actions for the university boards.

Regional event: Mechatronics Workshop

On 20-21 June 2017, the Technical University of Denmark and SEFI organised in DTU an **International Seminar on Mechatronics 4.0**. This seminar discussed how can we educate engineers with interdisciplinary skillsets; who are ready to tackle the difficult tasks of conceptualising, designing, implementing and operating Mechatronics-4.0 solutions. In particular, the seminar aims to bring together industrialists, educators, enablers, decision makers and participants from

academia and industry to discuss notably Opportunities within the emerging fields of Internet of Things, Digitalisation, Cyber Physical Systems and Mechatronics; Trends in the industry and their needs from newly educated engineers; Challenges of the universities to implement these topics in the educational programs; Current best practices for teaching Mechatronics 4.0 from leading universities and organisations. The seminar included sessions on How the industry/

companies work within these fields? What are their best practices, and what they want from new engineers? Academics from around the world present their educational initiatives from around the world? How the decision makers at the universities address these needs and how educators share their experiences with each other? And What do we learn from these discussions? What should the stakeholders do to address the needs of the students, universities, the industry and the political bodies?

The seminar was sponsored by QUANSER and NI. A follow up workshop will be organised by NI in the context of the SEFI Annual Conference 2017 in Terceira in September.



Capacity building—Cooperation with China

This year again, SEFI participated in the preparation of the IIDEA Workshop organised together with IFEEES at the Tsinghua University. IIDEA, the International institute for Developing Engineering Academics (founded by SEFI and IFEEES in 2011) is a global training institute focusing on establishing global network of engineering faculty development programmes to disseminate learning about the transformation of EE worldwide. Since the creation of IIDEA more than 600 faculties in China from about 100 universities participated in these events. This year the workshop was on *The Pedagogy of Online Engineering-Competence and Ethics* on July 14-15. The facilitators and speakers were Dr. M. Auer, President of IFEEES, Dr. D. Zulin, Vice president International Association of Online Education, Dr. Greet Langie, KU Leuven, Faculty of Engineering technology and SEFI speaker, Dr. Susan Zvacek, (University of Denver), Dr. Syed Ahmad Helmi Sued Hassan, UT Malaysia and Prof. L. Morell, Founder of InnovaHiEd. The interaction with the audience was even better than the previous years and the participants highly participated in the discussions.

Our representative, **Dr. Greet Langie**, Vice dean for education, KU Leuven faculty of Engineering technology presented on day II a plenary on *Practical skills in EE – Design of a Learning Trajectory* and later facilitated a workshop on *Creating the ideal Lab*. Many attendees were interested in academic staff support and teacher training.

Discussions relating to the 2018 Tsinghua Workshop tool place already and possible topics might be *Teacher training and community support in order to have an excellent professional degree program at the universities in preparation of industry 4.0/manufacturing 2025 (tbc)*.



The event was organised by IIDEA and CEE, and hosted by the International Centre for Engineering Education under the auspices of UNESCO (ICEE). In the context of this longstanding cooperation with China and Tsinghua University in particular, SEFI Secretary General **Françoise Côme** was invited by the President of the Chinese Academy of Engineering (CAE) Prof. Zhou Li, to become member of the Governing Board of the ICEE.

Published in September 2016 as a SEFI Working paper published together with University College London, **The London Agenda**, inspired by the ECED 2015 "Valencia Vision", highlights the most important issues, challenges and opportunities for schools of engineering today. London Agenda is divided into three themes:



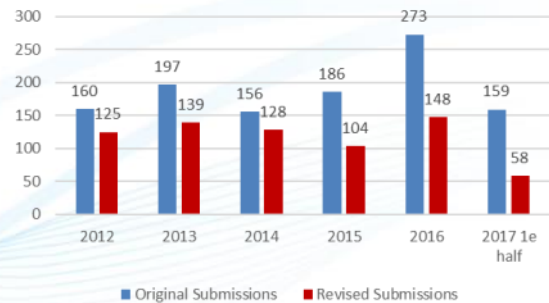
- **Engineering Education: Meeting the Engineering Profession's needs**
- **Engineering Research and Innovation: Meeting the needs for Sustainable Development**
- **Engineering Schools Adapting to Change: How much, how fast, and in what way?**

For each theme, there is a list of questions which conference delegates agreed on as important. However, these lists may not be complete, and there also may be more than one correct answer to each question because the context of each engineering school is different. We hope the London Agenda will help and inspire deans, directors and department heads to focus better on their roles in engineering education and research. We further hope that more colleagues across Europe will see the benefit of working together and meeting annually at ECED for the exchange of support and ideas whilst contributing to the advancement of engineering institutions in general.



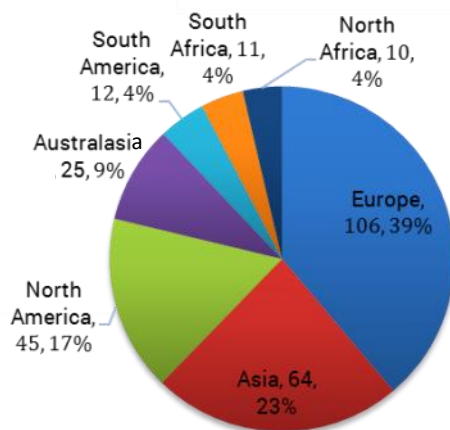
European Journal of Engineering Education

The SEFI European Journal of Engineering Education (EJEE), is published six times a year in print and electronic editions and provides an essential forum for dialogue between researchers and specialists in the field of engineering education. As one of the leading journals in engineering education EJEE includes both research articles as well as practice oriented papers. EJEE aims to publish papers that are of interest for engineering educators in Europe covering topics that are of interest world-wide and with authors from around the world well represented. Over the past years the number of papers submitted to EJEE roughly stayed in the range of about 180 papers /year. Starting in 2016 we can see a marked increase to 273 submissions. It looks like this trend is continuing in 2017.

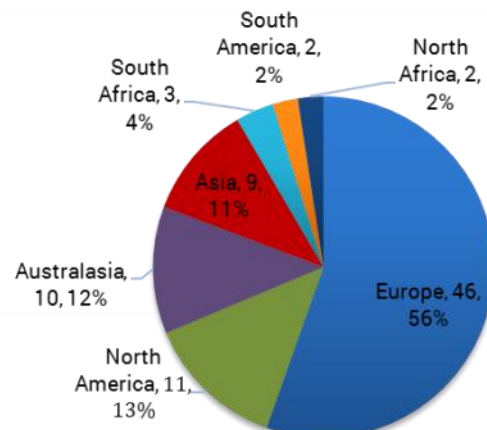


The regional distribution of submitted papers suggests that the increase of submitted papers for a large part comes from outside Europe, notably from Asia, North America. The contributions from Australasia remain at a high level of good quality papers. The overall distribution of accepted papers reflects both the international character of the EJEE as well as the focus on Europe.

Regional distribution of Submissions



Regional Distribution of Acceptances



The overview below shows last years theme issues and the new ones that are being prepared. I am grateful for the work put in by the guest editors of these theme issues. Each and everyone of them experiences that it is always more work than you think: European Journal of Engineering Education Special issue on 'Engineering Education Research in Europe – Coming of Age' (Robin Clark and Jonte Bernhard) / EJEE Special issue on outreach and attractiveness (Lena Gumaelius and Anette Kolmos) / Active learning (Rui Lima Pernille Hammar Andersson, Elisabeth Saalman) / Research Methodologies that link theory and practice. EER – theme issue following up on REES 15 (Anne Gardner) / Formative assessment practices in Engineering Education (Esat Alpay and David Shallcross) / European Models of Engineering Education: Evolution and challenges (Linda Gardelle) / Inclusive learning environments (Susanne Ihlen, Kacey Beddoes and Grace) / CISPEE 2016 selected papers (Eva Morais and Maria Nascimento) / Scholarly Development of Engineering Education – the CDIO approach (Kristina Edström, Johan Malmqvist, Janne Roslöf) – in reviewing process/Educating engineers 2030 - PBL, social progress and sustainability. Inspired by IRSPBL 2017 (Anette Kolmos, Aida Guerra, Fernando Rodrigues) - call published/ Transitions into engineering education and professional practice: strategies for engagement and success. Inspired by the REES 2017 conference (Bill Williams) – call published.

The past year the editorial team remained the unchanged: Erik de Graaff, Aalborg University, Denmark, editor-in-chief, Esat Alpay, University of Surrey, United Kingdom, Jonte Bernhard, Linköping University, Sweden, Anette Kolmos, Aalborg University, Denmark and Bill Williams, Instituto Politécnico de Setúbal, Portugal. I would like to thank the associate editors over the years, the members of the editorial board and most of all the reviewers who have put in so much work guarding the quality of the journal, the SEFI HQ and the team from Taylor and Francis.

Prof. Erik de Graaff
EJEE Editor in Chief
Aalborg University



* Statistics on EJEE from Manuscript Central kindly provided by Ian Challand, Managing Editor Engineering Journals, Taylor & Francis.

SEFI organised or participated in the following events in Europe and worldwide

October 2016

Meeting of STELA project, Brussels, BE
SEFI Steering Committee, e-meeting

November 2016

XXII BEST Presidents Meeting, Warsaw, PL
CDIO Fall Meeting, Porto, PT
WEEF and GEDC 2016, Seoul, KO
2nd Worldwide EPS Meeting, Lleida, ES
ENAAE 10th Anniversary & GA, Rome, IT
EPICES Project International Meeting, Paris, FR
SEFI Board of Directors meeting, Brussels, BE
European Digital Forum, Brussels, BE

December 2016

Global Engineering Education Leader Conference, Shenzhen, CN
SEFI WG Maths, Annual meeting, Bratislava (SK)

February 2017

SEFI Steering Committee, e-meeting

March 2017

Meeting of STELA Project, Graz, AT

April 2017

9th European Convention for Engineering Deans (ECED) Munich, DE
SEFI Extraordinary General Assembly, Munich, DE
7th European University Business Forum, Brussels, BE
Spanish Industrial Engineering Deans Council (CDTI) - Plenary Assembly, Cadiz, ES
Horizon 2020 Mid-term evaluation, Brussels, BE
SEFI Steering Committee, e-meeting

May 2017

9th Physics Teaching in Engineering Education Conference, Zilina, SK
BEST General Assembly, Wroclaw, PL
SEFI Board of Directors at DTU, Copenhagen, DK

June 2017

Club de Lamennais (IESF), Paris, FR
International Seminar on Mechatronics, Copenhagen, DK
49th EUCEN Conference, Mainz, DE
GEDC Industry Forum, CEDEP, Fontainebleau, FR
124rd ASEE Annual Conference preceded by the ASEE International Forum, Columbus, OH, U.S.

July 2017

SEFI-IFEES IIDEA Workshop on Engineering Pedagogical Education for Teacher development and Global Competencies, Tsinghua University, Beijing, CN
14th Latin American and Caribbean Consortium of Engineering Institutions (LACCEI) Conference, Boca Raton, FL, U.S.
SEFI in BEST summer event in Porto, PT
SEFI Board of Directors, e-meeting

Coming up in the autumn of 2017:

45th SEFI Annual Conference, Terceira, PT
1st ENAAE Members Forum, Leuven, BE
7th World Engineering Education Forum, Kuala Lumpur, MYS



Dr. Seweryn Spalek (SEFI BOD) at BEST Presidents Meeting in Warsaw



Prof. Carlo Noe (SEFI BOD) at 2nd Worldwide EPS meeting in Lleida



Prof. Luis Sanchez (SEFI Vice-President) at CDTI Plenary Assembly in Cadiz

EU Projects



EPICES

EPICES - European Platform for Innovation and Collaboration between Engineer Students

EPICES successfully developed a European collaboration on a distance project-based learning framework and method, based on already existing and still developing technical platforms, i.e. collaborative and engineering tools. A special focus was made on teachers' role and students' coaching, from the analysis of what a coach should be in project based learning to training packages for teachers and development of assessment methods. *The project, coordinated by SUPMECA (FR), ended in March 2017 (FR)*



ReadySTEMgo - Early identification of STEM readiness and targeted academic interventions

The project aims to improve the retention rates of higher education STEM programs by focusing on the academic readiness of incoming STEM-students. It will identify among incoming STEM students those that are at high risk of dropout and may thus need additional support and we will support those students with the help of intervention programs in the early phase of their studies. *The project that is coordinated by KU Leuven (BE) will end in October 2017, after a meeting organised in SEFI 2017 Conference (BE)*



STELA - Successful transition for secondary to higher education using learning analytics

The project addresses the ERASMUS+ main priority to raising the quality of education through the use of learning analytics and learning semantics. To this end the project will develop, test, and assess a learning analytics approach that focuses on providing formative and summative feedback to students in the transition. *The project is coordinated by KU Leuven (BE) (2015-2018)*



PREFER – Professional Roles and Employability of Future EngineerRs (ERASMUS Knowledge Alliance)

The project aims to reduce the skills mismatch in the field of engineering, helping students identifying their strengths and weaknesses, and providing them opportunities and exploring the wide variety of engineering roles in the labour market. The project is coordinated by KU Leuven (BE) (2016-2018)

In 2017, SEFI also supported and participated in several EU projects applications (ERASMUS + or HORIZON 2020 EU programmes):

DIMINT (EU ERASMUS Capacity Building / HE CD) – Modernisation of teacher training and development in STEM subjects, a three-year project application submitted by University of Applied Science Bielefeld (DE)

DIASPOR Net (EU ERASMUS Jean Monnet) Crossroads towards HE of Multinational young migrants, for access to professional recognition, a three-year project application submitted by NTUA (GR)

EBCC Model (EU ERASMUS Strategic partnership (cooperation for innovation and the exchanges of good practices)- Education, Business and Community Cooperation model for a creative European EE – a two-year project application submitted by the TU Riga (LV)

COGENT INNOV (HORIZON 2020 Research and Innovation action) Developing a co-generation of new holistic innovators for a developing society – a three-year project application submitted by ENSTA Bretagne (FR)

GETuP (HORIZON 2020) – Implementing gender equality plans to unlock potential of RPOs and RFOs in Europe – a project application to be submitted (30 August 2017) by the Slovak TU Bratislava (SK)



Cooperation with Partner and Sister Organisations in Europe



BEST (Board of European Students in Technology)

SEFI and BEST leaders met on several occasions during the year. BEST was also involved in the ECED 20107 where BEST representative was invited as panelist for the session on accreditation. Prof. Jolly (in charge of the SEFI Student cooperation group) was also involved in the BEST summer event organised in Porto this July, and last April, SEFI Vice-President Sanchez-Ruiz represented SEFI at the BEST Presidential meeting in Wroclaw.



ENAAEE (European Network for Accreditation of Engineering Education)

Since November 2015 Prof. Jolly, in her capacity of Chair of the SEFI WG on Quality assurance and accreditation, is the representative of SEFI in the ENAAEE Board, whilst Françoise Côme remains the SEFI representative at ENAAEE General Assembly. SEFI and ENAAEE Presidents met notably in the context of the ENAAEE 10th anniversary celebration (Rome, November 2016) and of ECED 2017 where ENAAEE President Bernard Remaud had been invited as plenary speaker. Joint activities are planned for the future, and SEFI also participates in the preparation of the ENAAEE Forum organised at KU Leuven next October.

SEFI is a founding member of ENAAEE.



FEANI (European Federation of National Engineering Associations)

Regular contacts are maintained between general secretaries of FEANI and SEFI, who regularly met and exchanged information about their respective activities.



IGIP (International Society for Engineering Pedagogy)

Discussion about a possible joint conference was initiated during the year and decision should be taken by the Board of both organisations next autumn. SEFI should be represented at the IGIP 2017 Conference to be held in Obuda in September.



CESAER (Conference of European Schools for Advanced Engineering Education and Research)

Cooperation with CESAER has been enhanced with the organisation of the 9th ECED in Munich as mentioned earlier. CESAER should be associated to SEFI and TUM in the publication of the Munich Message, as an outcome of the ECED 2017. We are preparing together the 2018 ECED to be held in NTNU next May.



EUA (European University Association)

There continues to be good cooperation with EUA, with mutual exchange of information. SEFI is an associate member of EUA.

Cooperation with Partner and Sister Organisations Worldwide



ASEE (American Society for Engineering Education)

Mike Murphy, SEFI President-Elect, attended the ASEE Conference in Columbus on 24-28 June, and presented a plenary invited presentation at the International Forum. An ASEE Global Colloquium will be held the days preceding the 2017 SEFI Annual Conference, and joint meetings will be organised on this occasion. In return, ASEE president, Beville Watford, and the secretary general, Norman Fortenberry, will attend the SEFI annual Conference 2017.



IFEES (International Federation of Engineering Education Societies)

There is a very good cooperation between SEFI and IFEES. Next November, F. Côme will finish her second two-year mandate as member for the IFEES Executive Committee and First IFEES Vice President. SEFI will present a candidate to the Executive Committee elections 2017 to be held in the context of the WEEF 2017 in Kuala Lumpur. In 2016, Xavier Fouger represented SEFI at the IFEES meetings organised in the context of WEEF 2016 in Seoul. Regular meetings are organised bringing together SEFI and IFEES leaders.

SEFI is a founding member of IFEES.



GEDC (Global Engineering Deans Council)

GEDC President, Peter Kilpatrick and the incoming president Natacha DePaola were invited to the ECED 2017 as panelists. EEDC should be represented at the GEDC 2017 Annual Conference in Niagara Falls in October. In 2016, X. Fouger represented SEFI at the GEDC conf. at WEEF 2016 in Seoul last November.



LACCEI (Latin American and Caribbean Consortium of Engineering Institutions)

SEFI and LACCEI are partners in the joint initiatives for the global promotion of the engineering education. The two organizations cooperate closely under the umbrella of IFEES. In the 2016-2017, the cooperation focused on spreading of the European Quality Assurance System, EUR-ACE, in Latin America, and promoting joint ERASMUS+ applications between members of both associations. José Carlos Quadrado, current LACCEI President and SEFI board member, was present in the LACCEI annual meeting 2017 held in Boca Raton, US, as a SEFI representative.



IIDEA (International Institute for the Development of Engineering Academics)

Since the beginning of 2017, IFEES is fully responsible for the IIDEA Secretariat and web site. However, SEFI remains involved in IIDEA's activities, particularly in the context of the annual workshop organised with the University of Tsinghua. A report of the 2017 workshop can be found in this issue.

SEFI is a founding member of IIDEA.



IACEE (International Association for Continuing Engineering Education)

The cooperation with IACEE is very good and SEFI follows with a lot of interest the IACEE new developments. Regular contacts are maintained between both societies leaders. SEFI WG on CEE and LLL is deeply involved in the cooperation with IACEE, notably through the participation of its chair, Bente Norgaard in the IACEE Board as Vice President. *SEFI is a founding member of IACEE.*

Detailed reports on all the mentioned events and cooperation can be found in our newsletters circulated to our members and partners on a monthly basis. .

Working Groups

Gender and Diversity in Engineering Education

Engineering is empowering society in unprecedented ways. Engineering is innovative and can address Grand Challenges facing Europe and the world. Innovation is driven by personal experience and world outlook. Therefore, gender and diversity are core assets in innovation. In order to reach its full potential, the engineering education community should better include all parts of our societies. In particular, engineering education must actively engage and help promote the pursuit of engineering education and engineering careers with those interested and competent individuals who have been historically under-represented within engineering.

It is with this need that SEFI and the working group strongly believes that all must be provided with equality of opportunity to pursue and advance in engineering education and that no individual should experience marginalization or non-inclusiveness because of visible or invisible disparities. For example, among others, these disparities include gender, age, belief system, disability status, gender identity, gender expression, national origin, ethnicity, sexual orientation, and socio-economic status. SEFI is committed to increasing the participation, inclusion, and empowerment in all venues where engineering is taught, practiced, and supported. We consider the input of Gender and Diversity Research as relevant for our strategies, programmes and measures. Recommendations for stakeholders in university, accreditation bodies, industry, engineering organizations and political bodies were formulated in the SEFI position statement on "engineering skills" in 2016.

Diversity in all dimensions (individual, organizational and societal), fuels innovation and the development of imaginative, holistic and enduring solutions to global challenges. This is demonstrated in the SEFI Mission and the SEFI Diversity Statement since 2017.

Since the beginning of 2017 continuous reports about gender and diversity in engineering and engineering education, with special thanks to the SEFI headquarters, are published in the SEFI newsletter.

The working group Gender and Diversity in Engineering Education supports this organisational goal through international networking and experience exchange, through presentations and publications at SEFI Annual Conferences and the European Journal of Engineering Education (EJEE). We regularly have meetings at the SEFI Annual Conferences and integrate continuously questions of gender and diversity into the conferences. We are in contact with other working groups and work in synergy to produce a modern understanding of gender and diversity in engineering education.

For the next years we plan to integrate the gender mainstreaming process into all working groups to find out about gender and diversity relevant cross-sectional topics. We also aim to get more female engineers and engineering

educators for the keynotes at the SEFI conferences to make women in this field more visible. Additionally, topics from STEM Gender and Diversity Studies should have a stronger influence on the political statements and the membership activities of SEFI. This includes widening the diversity approach in engineering education concepts and especially in engineering education research regarding target group oriented engineering education.

We are in contact with several programmes and projects related to Gender and Diversity in Science, e.g.:

genSET (<http://www.genderinscience.org>),

the European Centre for Women and Technology (ECWT), a network of female engineers, working together with NSF and US universities (www.womenandtechnology.eu).

the international project Gendered Innovations in Science, Health & Medicine, and Engineering (<http://genderedinnovations.stanford.edu>)

Network Gender&STEM

(<http://www.genderandstem.com/>).

In the European Journal of Engineering Education we find under the TOP ten downloaded and most cited articles over the last five years several articles on gender and diversity. That motivates us to publish a special issue on Inclusive Learning Environments which will be published in 2018.



Dr. Susanne Ihssen, WG Chair

Technical University Munich

Gender Studies in Science and Engineering



Asst. Prof. Kacey Beddoes, WG Dep. Chair

University of Massachusetts Lowell

Department of Sociology

Mathematics and Engineering Education

Mathematics as an essential part of engineering education keeps its permanent position in the list of actual topics and issues on the SEFI agenda. Questions about the best strategies in teaching mathematical subjects at technical universities and possible ways how to adopt them into the educational practice are regularly discussed by participants of the SEFI annual conferences. Working Group on Mathematics established in 1982 is actively supporting these discussions and its activities are focused on dissemination of information about good examples to the practitioners - mathematics teachers at TU throughout the Europe. The aims of WG on Mathematics include providing a forum for exchange of views and ideas amongst those interested in engineering mathematics, and promoting a fuller understanding of its role in the engineering education and its relevance to industrial needs.

Activities of Working group are organized by an enthusiastic steering committee

In addition to promoting information about new trends in teaching mathematics within engineering education, WG activities are focused on improving communications and exchanges between teachers, researchers and students and developing cooperation between engineering educational institutions in order to contribute to the development and to the improvement of engineering education in the economic, social and cultural framework of Europe. WG issued continually 3 editions of curriculum documents. Activities include also co-operation in the development of courses and support materials and collaboration with industry, in order to recognise and promote the role of mathematics in the Continuing Education of the engineers.

Working group organises bi-annual SEFI-MWG European Seminars on Mathematics in Engineering Education. Last 18th seminar was held at the Chalmers University of Technology in Gothenburg, Sweden in 2016. The next seminar will be held at the Coimbra University in Portugal, on 26-29 June 2018. The seminars offer open discussions on topics such as: activation of learners, use of technology, assessment, content and learning outcomes, transition from school to university, students' attitudes towards mathematics, higher level learning goals, mathematical needs in continuing engineering education, integration of mathematics and engineering subject education. The main current topic is how to develop and assess mathematical competencies in engineering mathematics courses.

The group intends to foster discussion and provide orientation and supportive material for the steady and balanced mathematical education of engineers in Europe. These aims are in full co-ordination with the most important goal of SEFI, that is engineering education in general. The Working Group on Mathematics and Engineering education makes this goal specific and operable for the field of mathematics education.



Prof. Daniela Velichova, WG Chair
Slovak University of Technology

Physics and Engineering Education

The Physics Working Group assembles physicists who teach physics to engineering students. They encounter similar problems regardless the country, the weight, the generality or the applicability of the course they are responsible for.

The main action of the Physics WG is to organise "Physics Teaching in Engineering Education (PTEE)" conference every two or three years. The last event was PTEE 2017 in Zilina Slovakia, on May 18th – 19th 2017, hosted by University of Zilina. The conference theme was 'Challenges and solutions for effective teaching', which covered mainly the practical hands-on challenges that physics teachers in EE encounter in their everyday work. The next conference will be in 2019 in The Netherlands.

Additionally, the WG is involved the Erasmus+ Strategic Partnership **ReadySTEMgo**, for which SEFI acts as the main networking partner. This project aims to improve the retention rates of higher education STEM programs by focusing on the academic readiness of incoming STEM-students. Among incoming STEM students, we will identify

those, that are at high risk of dropout and who may therefore need extra support, and we will support those students with the help of intervention programs in the early phase of their studies. We will identify the key STEM skills and once these are characterized, existing diagnostic tests are selected and their predictive power will be gauged in order to identify with high validity the students in need of extra support. Finally, we will investigate which intervention tools can support these at-risk students and we will measure the effectiveness of current remediation programmes. The project will conclude in autumn 2017.



Prof. Juho Tiili, WG Chair
Tampere University of Applied Sciences

Open and Online Engineering Education

Open and Online Education have been qualified as important developments for the innovation of Engineering Education. It is not just open or online that decides about the level or quality of the innovation or progress, but it is the integration of these approaches in the daily practice that decides about the contribution these can make. Also on the level of research, there is still a lot to be done and yet what we see happening is that a continuous flow of ever more technologies are being developed and used in education. Most of these are consumer technologies, which are used in very different ways and with very different purposes, which makes it difficult to decide about the importance for education. As with open and online, these emerging technologies, like there are virtual reality, Internet of Things, Maker space and so on, are promising tools and approaches, but one needs to select, test and decide about the usability of these technologies in the micro-environment of the teaching and learning setting to make it work.

It is expected that the emerging development of technology will affect education much more in the coming years than we have experienced so far with open and online activities. Therefore it is an urgent consideration to widen the spectrum of the working group and develop a proactive approach when it comes to dealing with technology for education in a broad sense. This is supposedly one of the issues to discuss in the coming year and see how the WG can deal with this rather complicated aspect of technology use to improve education.

An increasing number of organizations are experimenting with different models of open and online education and continue to struggle with this development in relation to their educational policies. With the progression of open and online education and especially with the upcoming emerging technologies, existing educational models will continue to be challenged and dealing with this requires a pro-active approach from the engineering education institutions at large.

The WG aims to put these issues on the agenda and address the current trends and the questions that surface

with the emerging importance of the use of technologies in education.

At SEFI 2016 in Tampere, our WG organized a satellite event at the conference, which was a 6 hour workshop on 'How to develop online learning that will work?' The event was carried out in close collaboration with TU Delft (Netherlands) and MIT (USA). Details of the workshop are available [online](#). The workshop was adapted to the audience using a pre-conference survey. We also organized Collaborative event with the WG Curriculum Development as an Open Workshop on curriculum development and open education. And we presented a paper on 'Who is the learner of the Engineering MOOC'.

For the upcoming SEFI 2017 conference in Terceira, we are planning a WG meeting and a WG workshop, including an additional workshop organized by the WG Curriculum Development and Open and Online Engineering Education. We will present a paper about 'Emerging technologies & Engineering Education and the state of affairs in using Learning Analytics to improve education'.

SEFI WG development

The WG Open and Online will increasingly work together with the WG Curriculum development and Gender and Diversity to see where collaboration might help to achieve a better level of participation for all. This is part of the WG policy of SEFI to bring the backbone alive where and when possible.



Prof. Pieter de Vries, WG Chair
Delft University of Technology

Continuing Engineering Education and Lifelong Learning

During the SEFI Conference 2016 in Tampere the following areas of interest (activities) were identified such as:

Skilled workers in need of academic knowledge

University – Business Collaboration

Professional development of academic staff

Work-based learning - Work integrated learning

Expand to central Europe

Business Master Programs for Engineers

Collaboration on (journal) papers and funding applications

During the year 2016-2017, the WG participated in project application both with evaluation (results to be known in 2017):

ALTEF project - a Strategic Partnership Erasmus+

Experienced and skilled employees with a vocational background are needed more than ever for jobs, which formally require an academic education. However, so far learning methods and career paths are missing which would allow to acquire the necessary competencies at an academic level as well as within company lines at the same time. Classical

training frameworks (e.g. seminars) and educational programs (e.g. bachelor degrees) are either not tailored enough or lack the possibility to adapt a pace to the changing needs of their participants. The main objective is to create a work place integrated learning framework that can be implemented on a broad base for workers with a vocational background.

CROSS Project - a Knowledge Alliance Erasmus+

Boosting the Knowledge Triangle by applying Problem Based Learning in Business-University Collaboration (CROSS)" will develop and put into practice two new models of cross collaboration. - Four Student Projects, in each of which a small group of university engineering students will collaborate with a company in order to solve a clearly identified problem this company is faced with. - Two Innovation Projects, in each of which a group composed of company employees and of academic staff members will collaborate in order to develop a clearly specified engineering innovation case that this company would like to achieve.

Furthermore, members of the WG participated in the 49th

EUCEN Conference the 7th of June 2017 in Mainz where they presented a paper: From earth to heaven: formats to allow adult learners to combine working, living and learning by Katriina Schrey-Niemenmaa, Metropolia University of Applied Sciences, Finland; Bente Nørgaard, Aalborg University, Denmark; and Ellen Sjoer, Delft University of Technology, The Netherlands.

The WG Steering Committee meet during the EUCEN conference to start organizing a Workshop which will take place during the SEFI Conference 2017.



Dr. Bente Nørgaard, WG Chair
Aalborg University

Sustainability in Engineering Education

The mission of the Working Group (WG) for Sustainability in Engineering Education is to exploit the synergy of different institutional perspectives to accelerate the diffusion and development of sustainability in engineering education in Europe. Its aim is to establish and maintain continual interaction of committed and engaged Working Group Members, being scientists, researchers and/or professional engineers, all engaged in cross-institutional activities.

In 2016-2017, we focused on three types of activities:

To establish a more solid base for the WG regarding institutional representation and backing from committed members.

To encourage on-going cross-institutional projects, with a commitment to document and share the results in alignment with the Work Group Mission.

To update SEFI members on work group activities and highlights of broader interest.

We concentrated on marketing the workgroup at appropriate events and developing our activities. I am proud to say that we have reached what can be considered as a solid based of institutional representation and backing from committed members. The WG has representatives from 19 institutions - members of SEFI. It has been a key target to reach this level of outreach, as this creates room to build sub-groups with comparable interests.

In terms of cross-institutional projects, we had two initiatives initiated by the WG. One project focused on a comparable study in the field of accreditation systems comparing the French and the Danish accreditation frameworks, resulting in a paper which has been accepted for presentation at the SEFI 2017 conference. Furthermore, based on a proposal from the WG workshop at the SEFI annual conference 2016, the WG prepared a special issue of EJEE.

The final activity was to collect material for the homepage to present the members' interdisciplinary background, their diversity in affiliation (e.g. university/company relations) and their diverse fields of expertise.

In October, Jette Egelund Holgaard, Aalborg University will be succeeded by Jordi Segalas, Universitat Politècnica de Catalunya, in the position of WG chair.



Dr. Jette Egelund Holgaard , WG Chair
Aalborg University

Quality Assurance and Accreditation

Most of the WG activities were carried out as a part of SEFI's involvement in ENAEE (European Network for the Accreditation of Engineering Education) and in discussions on the Common Training Principles initiated last year by the European Commission (EC) and coordinated by the European Council of Engineers Chambers. This project related to the development of common requirements for European engineers who intend to work in another EU country. The recommendations made by the project partners (essentially European National Accreditation Agencies) were communicated to the EC and Mrs S. Weisswange, EC (DG Growth). Mrs Weisswange participated in the 2017 ECED in Munich where she presented *Common training frameworks: A cross national tool to facilitate European professional life*, an overview of this initiative and also answered questions from the deans who had expressed a certain reserve related to this initiative.

The WG took part in discussions about cross-border accreditation organised by ENAEE, which constitutes a problem in Europe. The text on "[Good Practices for Transnational Accreditation](#)" was adopted in November 2016 for a two-year period. There were more activities with ENAEE and further discussions about the European engineering education systems and the sharing of innovative practices, notably with neighbouring countries. The engineering education may differ, but this diversity can provide an excellent stimulation and

it certainly contributes to the development of pedagogical innovations. Accreditation should not in any way restrain this trend.

Presently, there is a debate about the adequacy of accreditation, in particular of the [FAFGS](#) (EUR-ACE Frameworks and Guidelines) for all types of engineers. In our view, accreditation is not about specific details of curricula but about an outside perspective and understanding the engineering programmes. The simplification of accreditation procedures, as notably discussed in Belgium and in France, will for sure also constitute a challenge for further debates, notably in the SEFI 2017 Conference in Terceira, and later in October 2017, at the ENAEE Forum in Leuven, which will be organised in close cooperation with SEFI.



Prof. Anne-Marie Jolly, WG Chair
Polytech Orleans/CTI

Engineering Education Research

The Working Group notes with satisfaction that Engineering Education Research (EER) is now well established as one of the major tracks at the Annual Conference. The working group will explore ways to further strengthen this area of activity within the SEFI community. We believe that with the Scopus listing of the conference papers, the desire to share EER work at the Annual Conference will only increase and facilitate the growth of engineering education scholarship. In this relatively new field, networking plays an important role to establish joint understandings of the potential and quality of EER. The activities of the Working Group can thus support junior scholars in their development and in their establishment as productive and recognised researchers.

The Working Group most visible activities take place at the Annual Conferences. In Tampere 2016, the Working Group arranged a workshop on the topic *The Scholarship of Teaching and Learning*. At the Azores conference a workshop on the topic *Publishing in an Engineering Education Research Journal* is organised.

There is, as discussed in previous reports, significant cooperation amongst many of the EER communities in Europe as a consequence of existing relationships (often originally formed through SEFI), events and projects contributing to

the health of the EER-community. Our partners include the Nordic Network for Engineering Education Research (NNEER, Nordic and Baltic countries), the European CDIO-network, and the UK and Ireland Symposium. The growth of EER in the Nordic countries, in UK, and in Portugal has been presented and analysed in recent papers authored or co-authored by members of the Working Group. In a similar vein, Robin Clark of Aston University and myself have been working the Special Issue of EJEE focused on EER in Europe that is now ready to be published.

As our next Annual Conference in the Azores approaches, we expect to see lively EER activity in terms of papers, workshops and networking. The aim of the Working Group is to serve this community, which contributes to future enhancement of the education of engineers through research that combines scholarliness and usefulness.



Prof. Jonte Bernhard, WG Chair
Linköping University

Attractiveness of Engineering Education

The working group has built connections to other SEFI Working Groups, CDIO network and IACEE, as attractiveness is an issue covering the whole lifetime from pre-university, university and careers having several directions of professional development. Furthermore, different pedagogical models and quality issues play an important part in building attractiveness. A first EU-funded project of the WG is in the application design stage. New partners can still join. The core of the project is to find the future competences of attractive engineering work in enterprises and for universities ways for developing those competences for students.

That study needs to be done in a European context, appreciating the different challenges in different parts of Europe. The WG has decided to keep all the earlier listed issues in the agenda such as What makes engineering education attractive? (easiness, not much reading/difficultness, challenges; appreciation of the profession, high income; possibilities to solve the most difficult human challenges; save the world; possibilities of changing career)-

What is happening before the university level? (the role of teaching, stem versus other subjects, gender attitudes, attractiveness examples from real life) - What happens in the university? (curricula, teaching and learning, diversity, university as a community, restrictions of study, tuition fees) - How continuing engineering education could be attractive? (should an engineer work in engineering field? how to keep the market value).



Prof. Katriina Schrey-Niemenmaa , WG Chair
Metropolia University

Curriculum Development

Currently, the CDWG is undergoing a process of renewal and definition of its objectives due to the changes both within European society, and the technological and academic society. As a result of the joint reflection in this past year, we present a new catalog of the WG priorities:

- The integration of science and technology advancements in engineering education.
- Mobility and exchange in Engineering Education.
- Enhancing Engineering Education by new technologies and methods (PBL, CDIO...)
- Educational Software and Videos.
- Quality assurance and evaluation.
- 21st Century Skills.
- Professional Development of teachers.
- Digital Literacy.
- Entrepreneurship.
- Open Educational Resources.
- Employability and Workplace Training.
- Virtual Reality, Augmented Reality, and 3D Experiences.

- Online Assessment.
- Learning Analytics.
- University-Industry Cooperation.
- Web Technologies in Engineering Education.
- Apps & Mobile Technologies.
- Pedagogical Innovations.
- Collaborative Learning Experiences.

Furthermore, in the context of the HORIZON2020 STIMEY Conference held in Cadiz at the end of 2016, we organized an informal seminar on curriculum development with representatives from countries like Finland, Germany, Greece, or Belarus.



Prof. Carlos Rioja del Rio, WG Chair
University of Cadiz

From SEFI Corporate Partners



Taking the challenge of evaluation in PBL

By capturing socio-technical interactions, a digital framework now changes the practice of project supervisors.



Xavier Fouger—Dassault Systèmes, Senior Director Global Academia Programs

Collective problem solving is the essence of an engineer's professional life. Recognizing that group-level performance is central to their competitiveness, businesses are in a perpetual search of new ways to improve collaborative work. Over the last decades, digital solutions have been critical in enabling new methods of problem solving in an increasingly international and multi-disciplinary context. As a provider of such digital infrastructure, Dassault Systèmes has reached a stage where its "3DEXPERIENCE" platform —a digital infrastructure specifically centered on project optimization—, emulates a virtual workspace in which technical but also social interactions can be promoted, tracked and evaluated. It has been a natural step to extend such problem-solving framework for industry into a problem-based learning infrastructure for engineering education.



This framework, "*ILICE*" (Inspire/Learn/Innovate/Create/Evaluate), is a comprehensive cloud-based workspace that facilitates socio-technical collaboration among co-located or distant students working in groups. By capturing deliverables as well as interactions at all stages of a project, ILICE offers supervisors new means to monitor, guide and evaluate learning at individual and group level, addressing several of the most discussed dimensions of PBL or any other project-centric learning activity, among them, evaluation. Indeed, several key attributes of the "Evaluate" section have been specifically implemented to facilitate more authentic assessments of learning outcomes.

Continuous supervision. The cloud based nature of ILICE's underlying platform is intrinsically a virtual workplace where participants in a project capture their thoughts and store numerous steps in the lifecycle of their deliverables. These events instantly update aggregated dashboards that are available to supervisors who then can intervene in the course of a group's activity, without being necessarily present. Interventions can relate to encouraging or challenging options taken by the group, investigating the causes of inactivity when remedial measures can still have positive impact, providing "wake-up calls" to individuals or to providing any type of guidance. By being continuously involved regardless of actual physical presence, supervisors build a deep understanding about the groups and individual dynamics all along the project.

Attributability. When examining collective deliverables of a project, supervisors often meet difficulties in determining the actual share of each student in such results. By relying upon named-user access control and precisely allocated system rights, the ILICE framework accurately tracks the individual contributions at many levels of the computer models that describe the project's intermediate and final deliverables.

Peer evaluation. Ratings of results or of work attitudes by peer students is automated by making captured interactions

and project deliverables visible to anyone within a students' team or, at supervisor's discretion, across teams. Discussion-based peer evaluations are recorded and rating mechanisms, familiar to any social network user, are provided.

Collaborative attitude evaluation. Employers strongly encourage spontaneous collaborative attitudes of helping each other within an industry project. To encourage such attitudes during project-centric learning activities, educators who piloted the early use of the ILICE framework, triggered students to ask "questions", which are made visible within or across teams. Answers provided by peers in a chat style are captured and assessed for relevance by supervisors to rate the willingness and sincerity to help and individuals are credited for those behaviors in their overall evaluation. Supervisors can also choose to rate questions instead of answers by organizing a critical review of "questions" at the end or in the course of the project.

Rich defense. A powerful evaluation tool of group work is the intermediate or final exercise by which students formally tell the story of their collective progress, the difficulties they met and the strategies or knowledge they mobilized to overcome them. Students find in the platform numerous tools to recollect the creative and human process they experienced and to graphically illustrate the milestones of their journey. Supervisors then better evaluate self-critical attitudes and can reflect upon means used by students to rationalize and share their experience.

Involving third parties. Another natural use of the cloud architecture of the platform is the involvement of industry tutors by providing them with specific access profiles to the work of a student's group. At any time they can remotely monitor and/or intervene in the workspace of the group they tutor. Not only are they so given the means to provide a more authentic context, they also build their own intimate understanding of the dynamics of the group and better substantiate their evaluation statements through recorded events.

As the use of the ILICE framework expands, Dassault Systemes now starts its application in distant, teams to better understand its contribution in an intercultural context, where students collaborate with peer whom they will never meet under the supervision of tutors living on another continent. The resulting problem solving exercise will then more completely mimic the conditions of professional life for an even more realistic learning experience.

Fully customizable by educators the ILICE framework can be activated by any user of the 3DEXPERIENCE platform and is provided upon simple request at: <http://academy.3ds.com/lab/>



Discover ILICE on video



Materials Education SYMPOSIA 2017

9th International Materials Education Symposium



Overview by Mike Ashby (University of Cambridge and Granta Design)

Chair of the Symposia Academic Advisory Committee

These Materials Education Symposia continue to grow in size, diversity and quality. This year was held at Clare College, University of Cambridge and with 142 participants from 22 countries, it was the biggest and, to my mind, the most diverse and far-reaching thus far. I won't attempt to describe all the talks but rather try to convey a sense of the breadth and range of the talks and discussion.

The term **MOOC** (Massive Open On-line Course) was coined in 2008, but the concept first gained real traction in 2011 with Stanford and MIT offering to distribute course material free of charge over the internet. Early MOOCs tended to be little more than course notes on-line but it quickly became apparent that a more professional approach, requiring substantial investment, was needed to provide an effective educational environment. This environment began to take shape in 2012 with the emergence of the platforms such as Udacity, Coursera and MITx. Since then MOOCs have evolved into a sophisticated educational structure that is changing the shape of teaching both inside and outside the universities in which they originated. Just how sophisticated emerged from the talks by **Lorna Gibson** and **Jessica Sandland**, working with MITx, **Mark Miodownik**, working with UCL and the BBC, **Mark Endean**, working with the Open University and **Javier Orozco Messana**, working with the Universitat Politecnica de Valencia in Spain.

The afternoon contrasted the differing approaches to materials education in Sweden (**Maria Knutson Wedel**), China and Western Europe (**Sybrand van der Zwaag**), Japan (**Koichi Ohtomi**) and France (**Alexandre Mege-Revil** and **Amina Tandjaoui**). The session ending with a delightfully original way to introduce students to issues of health and safety, using chocolate.

The morning of Day 2 focussed on attracting students into Materials (**George Smith**) and providing them with an education that meshed with the needs of industry (**Karen Pantleon**, **Luc Salvo**, **Laura Katharina Thurn**, **Steffan Ritter**, **Paul Eason** and **Jose Ygnacio Pastor**). The emphasis here was on developing products from the design stage through material and process selection, prototyping to final production, in close collaboration with industrial partners. The importance of introducing students to the realities of production engineering and to new technologies such as additive manufacturing was emphasized.

Materials and Product Design is a recurring theme of past Symposia. The challenge is to bridge the gap in language and thinking-processes between Industrial Design, Engineering Design and Architecture. Talks on these topics are always liberating, detaching the experts on each field from their comfort zone to explore the others' territory. The session started with a central tool of Industrial Design, the Materials Library (**Gerhard Glatzel**), followed by descriptions of current initiatives at one of the great schools of Design for which Italy is famous: the Politecnico di Milano (**Barbara Del Curto**, **Valentina Rognoli** and **Camilo Ayala Garcia**). A recurring question arises here as in other fields of teaching: how much of what we teach will really be used by the student in later life? **Frederic Veer**, a master of the provocative talk, described a course to address this concern. Three distinct disciplines met during this final afternoon so it was appropriate that the final talk of the day (**Max Fickel**) proposed a blueprint for a Transdisciplinary Research Network, a kind of knowledge-exchange in Materials, Engineering and Design – a concept that resonated with many of the participants in this very stimulating meeting.



Mike Ashby

Feedback

The quality of the talks is very high. There is an interesting mix of design projects and how people are teaching courses. It's a very good mix – a session of talks for 90 minutes and breaks with time to talk to people, to mingle and chat. People are very friendly, there are lots of opportunities for informal discussion. I met some good new contacts that I will follow up with after the Symposium. I'm hoping that we can get a similar crowd [at MIT, August 24-25, 2017] and equally good talks and interactions. MIT will be a good venue for it.

— Lorna Gibson (Massachusetts Institute of Technology)

Courses, workshops, posters, networking and social program

The main Symposium program was preceded by a Granta Design CES EduPack course (led by **Mike Ashby** and **Claes Fredriksson**) and workshops on enhancing blended learning (led by **Mark Endean** from the Open University), sustainable development (led by **Mike Ashby** and **Tatiana Vakhitova**) and advanced materials selection with Granta's CES Selector (led by **Charlie Bream** from Granta Design). 40 Symposium participants joined these, picked up useful hints and tips, and explored aspects of these topics in detail. We are very grateful to **Noel Rutter**, **Jess Gwynne**, and the Department of Materials Science & Metallurgy who provided an excellent venue and support. Feedback from those that participated was very positive and we hope to offer additional workshops next year.



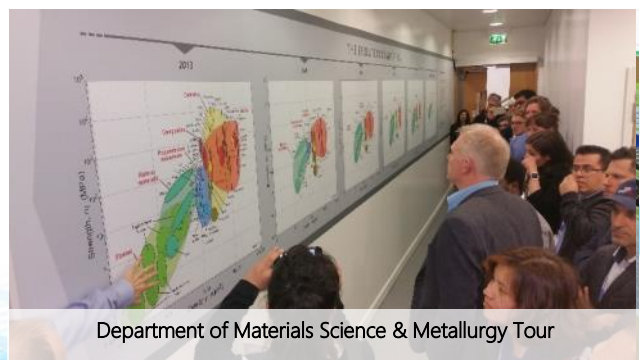
Poster Teaser Session



Lunch in the sun

The 'poster teaser' and one-hour poster session was the strongest to date with 37 posters. As in previous years this proved to be one of the highlights of the Symposium stimulating a great deal of discussion and providing excellent opportunities for networking.

Many participants said they also greatly enjoyed the Social Program, which offered the opportunity to meet friends from the growing Symposium community, or for first-time visitors to make new contacts. The Presenters' Dinner at Clare College (founded in 1326) and the Symposium Dinner at Gonville and Caius College (founded in 1348), provided a wonderful environment in which to continue discussion.



Department of Materials Science & Metallurgy Tour



Final words by Marc Fry (Granta Design)

Secretary of the Symposia Academic Advisory Committee

Thank you to all participants for making this Symposium a great success. Mike and I would particularly like to thank the International Academic Advisory Committee for their help in selecting a strong program from the many excellent submissions, the session co-chairs and my Granta Design colleagues for their dedication and hard work in the background ensuring the Symposium, as always, runs smoothly. We would also like to express our appreciation for the continued support of our colleagues at **Granta Design**, **ASM International**, the European Society for Engineering Education (**SEFI**), the Federation of European Materials Societies (**FEMS**), the International Federation of Engineering Education Societies (**IFEES**), The Minerals, Metals & Materials Society (**TMS**), and the Departments of **Materials Science & Metallurgy** and **Engineering** of the **University of Cambridge**. We now look forward to 10th International Materials Education Symposium April 12-13, 2018.

If you would like to find out more please visit www.materials-education.com

USER STORY

University College London Improves Computational Literacy with Online and Onsite MATLAB Training



First-year students using MATLAB for mathematical modeling.

University College London (UCL) is one of the world's leading multidisciplinary universities and the top-rated university in the U.K. for research strength.

Recently, UCL revamped its undergraduate engineering and computer science programs to link theoretical studies with practical exercises and projects. In parallel, UCL introduced a program in which postgraduate students work with local companies to solve business challenges using data analytics. Both initiatives were enabled in part by campus-wide access to MATLAB® via a MathWorks Total Academic Headcount (TAH) license.

"As part of our new curriculum, we created a first-year mathematics course that focuses on modeling because that's what engineers usually use mathematics for and is based on MATLAB because that is the tool researchers and engineers use to model the world," says John Mitchell, vice dean education at University College London Engineering.

Online and onsite training has contributed to a 100% increase in the number of UCL undergraduate and graduate students using MATLAB in their studies and on research projects. "With the online resources from MathWorks, students can learn MATLAB outside class and instructors can spend more time teaching the core material," Mitchell says.

The Challenge

As UCL faculty began to place a stronger emphasis on problem-based learning, they identified three requirements. First, instructors needed problem sets that reflected

real-world challenges in math, science, and engineering. Second, students needed access to the best tools for solving those problem sets. Third, faculty needed a way to introduce these tools to students in their first year without committing time and resources to developing a new course or formal lectures.

Faculty teaching graduate-level courses had similar requirements. In the master's business analytics program, for example, students needed access to tools used by practicing data scientists. Because these students work directly with businesses, they needed to quickly develop the skills needed to solve data analytics problems using these tools.

The Solution

UCL used online training courses from MATLAB Academy and MathWorks onsite training services to support its curriculum changes and increase computational literacy and MATLAB usage across campus.

The university established *Mathematical Modeling and Analysis*, a new first-year course for undergraduates that teaches the core mathematics, modeling, and analysis skills needed in later engineering coursework.

In this course, students use MATLAB to complete problem sets based on concepts covered in lecture. In early assignments, students perform basic calculations with vectors in MATLAB. Later assignments involve differential calculus and mathematical modeling.

Throughout the course, students learn MATLAB fundamentals and programming techniques from courses in the MATLAB

The Challenge

Enrich student coursework with project-based learning while enabling instructors to focus on teaching core concepts

The Solution

Acquire a MathWorks Total Academic Headcount license and use MathWorks onsite training and online courses to accelerate student adoption of MATLAB campus-wide

The Results

- Program scalability enabled
- Faculty and students focused on addressing real-world problems
- Students equipped with required tools and skills

“One advantage of teaching with MATLAB is that our students are exposed to a tool that is used in the commercial world. The quality of the learning materials delivered online and onsite was excellent, enabling me to focus on teaching analytics and working with students.” —DANIEL HULME, UNIVERSITY COLLEGE LONDON

Academic Online Training Suite, including *MATLAB Fundamentals*.

At the postgraduate level, students in the business analytics master's program use MATLAB with Statistics and Machine Learning Toolbox™ to complete projects that address challenges faced by real companies.

Before embarking on their projects, students in *Programming for Business Analytics* learned how to apply data analytics techniques using MATLAB. For three weeks, a MathWorks training engineer conducted workshops and onsite training that included content developed specifically for UCL business analytics students.

On one project, students used MATLAB to develop a solution that helped an energy company reduce costs by £59 million.

Now that UCL undergraduates learn MATLAB in their first year, UCL faculty are integrating MATLAB and Simulink® into upper-level courses, including a second-year course in which students will use Simulink and Arduino® hardware to develop real-time control systems for quadcopters. With these additional computational skills, students will be able to solve larger, more complex, and more realistic problems.

The Results

Program scalability enabled. “My business analytics program will grow from 50 to 100 students over the next three years,” says Dr. Daniel Hulme, senior research associate at UCL. “The only way I can scale the program is by having the students do more self-learning through MATLAB Academy and other online resources.”

Faculty and students focused on addressing real-world problems. “The MathWorks onsite training did a much better job of delivering MATLAB content than I could,” notes Hulme. “That enabled me to concentrate on adding context and helping students apply that content to solve real-world problems.”

Students equipped with required tools and skills. “In the first 15 months after offering onsite training and access to MATLAB Academy, UCL saw MATLAB activations double,” says Mitchell. “Onsite training and online learning have helped UCL make the most of the TAH license. Campus-wide access to MATLAB is a real bonus to all our students.”

Industry

- Academia

Application Areas

- Data analytics

Capabilities

- Data analysis
- Algorithm development
- Mathematical modeling

Products Used

- MATLAB
- Simulink
- Statistics and Machine Learning Toolbox

Learn More About University College London

www.ucl.ac.uk



Building a Comprehensive Lab Sequence for an Undergraduate Mechatronics Program

Tom Lee, Ph.D., Chief Education Officer, Quanser

Motivation

The global engineering academic community is witnessing an explosive growth in the number of programs and courses in mechatronics. They take the form of options within conventional departments, or as fully realized programs. This is not surprising as society is inundated with chatter about the "Internet of Things", robotics, drones, etc. Additionally, within the engineering profession, the computer control of complex engineering systems is now firmly entrenched in a principal framework for increasing the precision, performance, efficiency, and decreasing the cost of modern systems. Understandably, the mechatronics programs are part of the academic response to these trends.

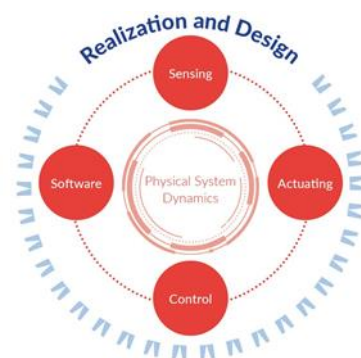
Challenges

By its nature, a mechatronics program relies heavily on hands-on experiences and labs. Microprocessor programming, sensor integration, or hobby robotics are all very typical kinds of labs that many institutions have introduced. A common lab sequence sees students programming hobby microprocessor boards and then connecting them to simple sensors to operate small motors, lights, or other components. Because of the use of hobby-grade components, often the essential learning challenge becomes the programming as opposed to the system in addition to the programming. The physical system itself often remains relatively simple in configuration.

While the core curriculum sequence of most undergraduate engineering programs is based on modeling and analysis of complex physical systems using mathematical and scientific methods, the mechatronics lab sequences remain problematically disconnected from this core. Quanser's contribution in this context is to offer a learning platform that reconciles the traditional applied sciences with modern mechatronic technique.

The Quanser Method for Mechatronics

The term Quanser Method refers to a core philosophy of harmonization of key concepts and techniques that are often treated independently in a curriculum sequence. For mechatronics programs, the Quanser Method focuses on the development of fundamental skills in a guided way that effectively prepares students to apply those skills in a more open-ended project and design context. Significant emphasis is placed on the inherent dynamics of engineering physical systems. In this way, the method differentiates itself from a programming-centric approach, and arguably is better at conceptually connecting to the majority of courses in typical undergraduate programs.



Towards "High Fidelity" Mechatronics

The aim is to establish a skills framework for high fidelity mechatronic design – i.e. the conceptualization and realization of applications that exhibit dynamic fidelity and real-world relevance.

Dynamic fidelity is a fundamentally desirable attribute for educational applications. The majority of the courses within typical undergraduate curricula still stress the benefits of rigorous, modeling-focused analysis and design. Dynamic fidelity is the deterministic behavior of systems that suitably and consistently matches the descriptions within course theory. Ideally, the lab exercise should help make sense of the theory and not be seen as an alternative to the theory.

Relevance is a complex notion, and can range from systems that are end-applications themselves (e.g. a robot), or can be more abstract, but offer a motivating context when the system performs an action that is clearly challenging, but made easier through mechatronic methods (e.g. balancing an inverted pendulum).

Both of the above are a direct consequence of the central importance of the actual physical system, as opposed to a principal focus on programming.

Increase Application Complexity and Relevance

Severe time constraints in a course has historically meant that students could not surpass the most basic activities in a lab, as more complex or realistic examples would require steps and details of implementation that would prevent such exercises in a regular course. This is especially true when an institution bases its labs on hobby microprocessors or sensors/motors.

A principal philosophy in Quanser's technology platforms is to minimize implementation detail, so that students have a real chance to experience with some depth more interesting and relevant examples and exercises. The examples can move beyond the very basic to important applications involving high precision components with deterministic dynamics, industry-standard integration protocols, and human interface components such as keypads and LCD displays. Consequently, students do more and learn more without the time penalty that is demanded by hobby platforms.

The result is a unique sequence that take students from the very basic to advanced concepts and design:

Essential skills for undergraduate mechatronics: [Quanser trainer boards for the NI Educational Laboratory Virtual Instrumentation Suite \(NI ELVIS\)](#) undergraduate lab platform cover arguably the most important technical hardware-focused skills in mechatronics: sensing, actuation, and integration (protocols).

Control of complex dynamics: The next step is to increase the complexity of the system and allow students to experience how modern engineering techniques can manage challenging situations. The control of complex dynamics is a key element here as it makes sense of the mathematics and modeling concepts introduced in the core course sequence and places these concepts in context of system design.

Programming: The final dimension is the software experience. One of the biggest impediments to introducing meaningful system complexity into student labs is the programming effort in general languages like C. [Quanser plants and trainers](#) take advantage of industry-standard high-level system-design oriented computing environments including [LabVIEW™](#) or [Simulink®](#). Enhanced with Quanser software, students work at the application and system level, and leave the details of I/O and implementation to the plug and play software.

Related skills: The above describes the sequence for the core set of skills for mechatronics. Additionally, Quanser provides a range of [teaching resources](#) that offer engaging experiences in related applied sciences that help connect mechatronics concepts to specific physical system domains.

Preparing for Engineering Complexity

The Quanser Method for mechatronics is, in essence, a preparatory sequence of experiences

- they effectively provide the skills and insight through appropriately constrained, guided, and engaging exercises well-connected to the theoretical foundations. In many ways, however, this is incomplete. Quanser fundamentally believes that the learning sequence is not complete until a student directly addresses the real design challenges in the real world. This is done in the context of design projects.

About the Author



As Chief Education Officer at Quanser, a leader in real-time control and mechatronics solutions for education, research, and industry, Dr. Tom Lee develops and implements the company's strategy for enriching and increasing the educational effectiveness of technology in the modern engineering education context. Dr. Lee also serves as Adjunct Professor of Systems Design Engineering at the University of Waterloo, noted for its leadership in engineering, computer science, and mathematics.

More info at www.ni.com/quanser, www.quanser.com



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Following the interest of a number of companies to cooperate with selected working groups, SEFI now offers a new type of corporate cooperation – the "Corporate Working Group Supporter". This type of cooperation is designed for companies aiming to work with one specific SEFI working group. We offer the participation in the group activities, the access to general SEFI information (monthly electronic newsletter and bi-monthly printed journal) and the company link on the SEFI working group's website.

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