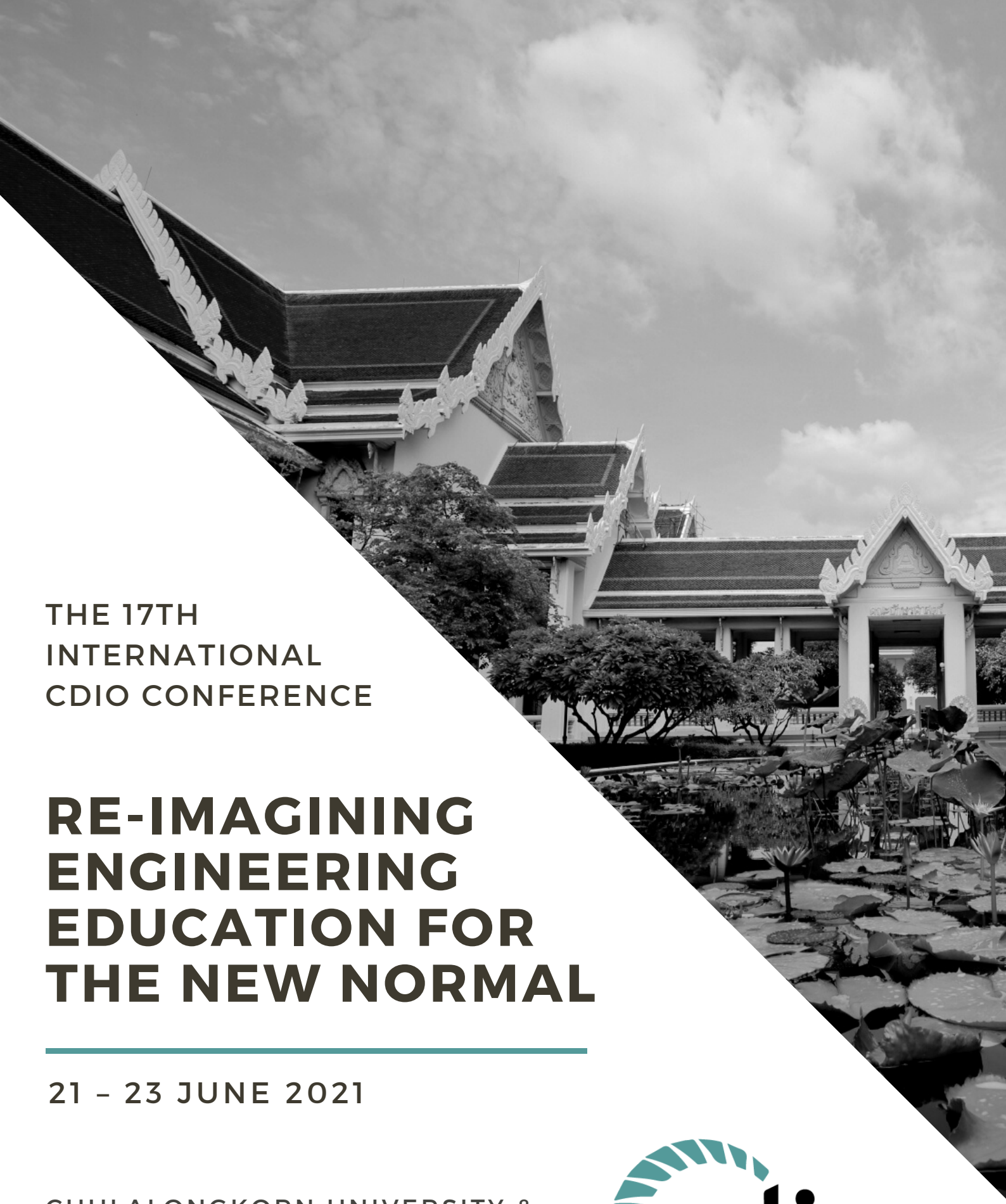

THE 17TH
INTERNATIONAL
CDIO CONFERENCE

RE-IMAGINING ENGINEERING EDUCATION FOR THE NEW NORMAL

21 – 23 JUNE 2021

CHULALONGKORN UNIVERSITY &
RAJAMANGALA UNIVERSITY OF
TECHNOLOGY THANYABURI

cdio™
BANGKOK 2021

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WELCOME MESSAGE

On behalf of the Faculty of Engineering, Chulalongkorn University, it's my great pleasure to welcome you to the 17th CDIO International Conference on the online platform. The spread of the COVID-19 pandemic has had an impact on our daily lives, as well as education, which is a critical component of our national development. As more learning management platforms emerge, instructors have to adapt their teaching methods to improve students' comprehension while students have to set up effective equipment and internet connection and not to mention the stress that both instructors and students have to deal with. These consequences are crucial concerns in which all academic administrators and staff must encounter. In addition, Faculty of Engineering, Chulalongkorn University, or Chula Engineering would like to support you all and contribute to the development of innovations to assist medical personnel in overcoming our country's crisis.

The 17th CDIO International Conference hosted by Chula Engineering with as a co-host Rajamangala University of Technology Thanyaburi under the theme of "Re-imagining Engineering Education for the New Normal" is another activity which all participants could share their experience as academic personnel. In this time, we will see how academic personnel applied CDIO learning management to overcome obstacles in the current situation and transition to a New Normal and also see what will happen in the post-crisis period. Higher education institutions have to adapt themselves, so does Chula Engineering. We will continue to support our faculty members, students and academic personnel to learn the CDIO learning management framework and improve our academic platforms and infrastructure in order to be transformation-ready.

I would like to thank and acknowledge all the support team who have worked hard to make this conference a truly success and I sincerely hope this conference will be enjoyable and fruitful for every one of you. Last but not least, on behalf of Chula Engineering, I would like to extend my gratitude and support to all academic and medical personnel including everyone who are dealing with this crisis. Together we can go through this situation.

Thank you.

Professor Supot Teachavorasinskun, D.Eng.
Dean Faculty of Engineering
Chulalongkorn University

First of all, I am hoping and praying for the speedy and full recovery of the situation all over the world as mankind is still battling for its very survival from the ravages of COVID-19. A global pandemic that not only wreaking havoc to the economy around the world but still continue affecting the all aspect of humanity as the world is yet to be fully vaccinated. We have witness the greatest challenge of the 21st century.

I am extending my salute to all the brave doctors, health workers, all supporting staff and other people who are working in essential services. It is their bravery, passion and dedication to their sworn profession that's keeping us all going. We pray for strength and perseverance and we wish to fight together for going through the difficult times.

I would like to extend my warmest regards to all of you. Thank you for the efforts for attending the 2021 CDIO International Conference under the new normal in which Thailand is hosting. Without your commitment and support this event won't be happening.

International collaboration and networking are essentials to address global challenges. It is our interest to be an active participant in international engagement in every field of discipline, aimed at addressing the challenges of education and to position Rajamangala University of Technology networks to become competitive international institution. Working with international universities is one of the most important priorities of Rajamangala University of Technology Thanyaburi (RMUTT) especially in this time of global pandemic. It is true that CDIO as curriculum model for education raises people's productivity and promotes entrepreneurship and technological advances. In addition it plays a very crucial role in securing economic and social progress and pushes us to do our best to address the challenges in education under the new normal.

I would like to say that I am confident that our effort and commitment for educational upgrade that keeps abreast with the challenges of modern time will bear fruit of quality and productive students that will help in nation building of Thai people as a nation and Thailand as a country.

Finally, I will assure you that RMUTT will do our commitment to provide a successful and productive implementation of CDIO in our educational curriculum. I would like to express my sincere gratitude to all people who cooperated and work hard for the success of 2021 CDIO International Conference. I hope that this pandemic will be over soon. I hope that this challenge will teach us the lesson that we need each other to survive and defeat this pandemic.

Thank you so much.

Assistant Professor Sommai Pivsa-art, D.Eng.
President
Rajamangala University of Technology Thanyaburi

MESSAGE FROM CDIO CO-DIRECTORS

The CDIO international conference brings together the entire CDIO community once a year. Although we are happy we can meet virtually, it is unfortunate we cannot meet in-person for the second year in a row. The pandemic has had a significant impact on our work and community, and will most likely do so in the coming period. But it has not changed the problems universities are facing. While it is impossible to predict how our institutions will rebound in the wake of the virus, the CDIO community of practice can and should use this conference to think and plan ahead. If there's one lesson the pandemic has taught us, it is that future always comes too fast and in the wrong order (quote Alvin Toffler).

As was only to be expected, the main theme of this 17th International CDIO Conference is 'Re-imagining Engineering Education for the New Normal'. Who tells us what that New Normal will be? For the CDIO community it is not a matter of adapting to the New Normal, but shaping it. Long after the lockdowns are over, one effect of the pandemic will be the permanent changes to traditional modes of learning. Face-to-face no longer is the most effective method for education, digital is no longer a 'nice-to-have' but a 'must-have', and remote project-based and collaborative learning can also yield effective virtual team-based learning experiences at scale, preparing the students for employability in the world of the 4th Industrial Revolution and digital transition.

This CDIO conference, organised jointly by Chulalongkorn University and Rajamangala University of Technology Thanyaburi (RMUTT), Bangkok in Thailand is an excellent opportunity to be inspired by fresh ideas and new methods that can help you to enhance your courses, projects or curriculum. This conference has tracks about online modes during the pandemic and towards New Normal, about advances in the CDIO framework and community, engineering education research, and three workshops and six roundtable discussions. They all give you the opportunity to develop new perspectives and strategies on the integration of online, remote and in-person learning and educational technology in your programme, or upgrade otherwise.

We are excited to welcome you to this virtual conference and wish you all an enjoyable, inspiring, and rewarding conference experience. We wholeheartedly hope to meet face-to-face again in Reykjavik in 2022.

Aldert Kamp and Helene Leong
Co-directors of the CDIO Initiative

KEYNOTE SPEAKERS

Dr Pailin Chuchottaworn

Advisor to the Thai Prime Minister
Chairman of the Board and Independent Director the Global Power Synergy Public Company Limited

Dr Pailin was the Chairman of the Council of Vidyasirimedhi Institute of Science and Technology (VISTEC) and the Chairman of Kamnoetvidya Science Academy (KVIS) Executive Board. His past experience includes the former Deputy Minister of Transport, high-level executive and advisor to the Royal Thai Government, private companies and educational institutions with expertise on the education, economics, investments and energy industry in Thailand.

TRANSFORMING THE EDUCATIONAL CONTEXT FOR THAILAND IN THE NEW NORMAL ERA

Since 2020, the COVID-19 pandemic catastrophically affected aspects of life around the world, including education. Educational institutions in Thailand had to adopt the digital transformation immediately, triggering many questions. What and how the executives of educational institutions could do to tangibly support or direct a successful education in the New Normal? What will be the national direction of education? These were some of the challenges that the executives of educational institutions had to face.

KEYNOTE SPEAKERS

Dr Johanna ANNALA

Senior lecturer at Faculty of Education and Culture
Tampere University, Finland
Erik Allardt Fellow at Swedish Collegium for Advanced Study
Uppsala University, Sweden (2020-2021)

Johanna Annala has a PhD in education and master's degree in social sciences. She is a senior lecturer (university pedagogy) at Faculty of Education and Culture, Tampere University, Finland, and a co-leader of research group Higher Education in Transition (https://research.tuni.fi/het). She has a title of docent (adjunct professor), in the field of teaching in higher education at the University of Turku, Finland. In 2020-2021, she is a visiting fellow at Swedish Collegium for Advanced Study (SCAS), Uppsala University, and in 2019, she was a visiting fellow at the University of Melbourne, Australia. Since 2016, she has been several times a visiting professor in RMUTT in Thailand. Her research focus on curriculum change in higher education. In her work, she elaborates critically contemporary trends in higher education, but also tries to find meaningful and theoretically elaborated solutions for academic practice. At present, she investigates the nature of knowledge in a so-called 'hybrid curriculum' – in initiatives where a curriculum or parts of it are united in a research-intensive university and a university of applied sciences – and teachers' role in making decisions about knowledge in a curriculum of this kind

ACADEMICS AS CURRICULUM CREATORS IN HIGHER EDUCATION

Curriculum making is a repeated part of work in universities. If curriculum making is understood as pedagogical and educational development, it requires collaboration between different actors. Academics' have an irreplaceable role in that process as knowledge experts (scholars) and as educational experts (teachers). Curriculum making offers a place to negotiate of the relationship between university and working life, research and teaching, theory and practice, the roles of students and teachers, and individual and collaborative work cultures. These negotiations have a connection to the institutional and disciplinary traditions, cultures and practices, and the contemporary changes in the world of work, society, and educational policy, and the students for whom the education is intended. This presentation focus on the academics who act as curriculum creators in higher education, asking: what are the possibilities, challenges and tensions they face in curriculum making processes, and how to make that process a meaningful part of academic work.

PROGRAM OVERVIEW

Date	Monday 21 June 2021				
13:00-13:20	Plenary Session 1: Introduction Welcome speech: Dean Faculty of Engineering, Chulalongkorn University Program Overview				
13:20-14:00	Plenary Session 2: Keynote Speech Dr. Pailin Chuchottaworn				
14:10-15:10	Parallel Session 3.1 CDIO Implementation Online Modes during Pandemic, and Towards New Normal	Parallel Session 3.2 CDIO Implementation Internationalization	Parallel Session 3.3 Advances in CDIO	Parallel Session 3.4 EER	Parallel Session 3.5 Roundtable
15:20-16:20	Parallel Session 4.1 CDIO Implementation Sustainable Development	Parallel Session 4.2 CDIO Implementation Learning Progress Monitoring	Parallel Session 4.3 Advances in CDIO	Parallel Session 4.4 EER	Parallel Session 4.5 Roundtable
16:30-17:30	Plenary Session 5: Poster Session				
17:40-18:00	Newcomers' Welcome Session				
Date	**Tuesday 22 June 2021**				
13:00-13:20	Plenary Session 6 Welcome speech: President RMUTT Program Overview				
13:30-14:30	Parallel Session 7.1 CDIO Implementation Online Modes during	Parallel Session 7.2 CDIO Implementation Project-in-Progress	Parallel Session 7.3 EER	Parallel Session 7.4 Roundtable	Parallel Session 7.5 Workshop (75 Minutes) 13:30 - 14:45
14:50-15:50	Parallel Session 8.1 CDIO Implementation Project-based Learning	Parallel Session 8.2 CDIO Implementation Project-in-Progress	Parallel Session 8.3 EER	Parallel Session 8.4 Roundtable	Parallel Session 8.5 Workshop (75 Minutes) 14:50 - 16:05
16:10-17:00	Plenary Session 9: Keynote Speech Professor Johanna Annala				
17:10-18:00	Parallel Session 10: Regional Meeting				
19:00-20:15	Session 11 Workshop (75 Minutes)				
22:00-23:15	Session 12 Workshop (75 Minutes)				
Date	**Wednesday 23 June 2021**				
12:00-13:00	Parallel Session 13: Regional Meeting				
13:10-13:20	Plenary Session 14 Program Overview				
13:30-14:30	Parallel Session 15.1 CDIO Implementation CDIO Implementation	Parallel Session 15.2 CDIO Implementation Assesment	Parallel Session 15.3 Roundtable	Parallel Session 15.4 Roundtable	Parallel Session 15.5 Workshop (75 Minutes) 13:30 - 14:45
14:50-15:50	Parallel Session 16.1 CDIO Implementation Change Process	Parallel Session 16.2 CDIO Implementation Learning Experience	Parallel Session 16.3 EER	Parallel Session 16.4 Roundtable	Parallel Session 16.5 Roundtable
16:10-16:50	Plenary Session 17: Closing CDIO2021 Working Group report to plenary (5 minutes for each WG) Regional Meeting Report Council Member Election Introduction to the 18th CDIO International Conference (CDIO2022)				
17:00-18:00	CDIO Council Meeting				

Conference Program All times in Local Time Zone (GMT+7)

PRESENTATIONS, WORKSHOPS, ROUNDTABLE DISCUSSIONS

PODIUM PRESENTATION The author prepares a maximum 10-minute pre-recorded presentation. At the parallel session, the pre-recorded video is shown, followed by Q&A

POSTER PRESENTATION At the poster session, the author prepares one slide and makes a 1-minute pitch. The digital poster will be shown in a virtual breakout room where the author discusses the work with interested attendees

WORKSHOPS Workshops are interactive sessions on a specific topic with activities that are intended to engage the participants

ROUNDTABLE DISCUSSIONS Informal discussion of a topic proposed by a roundtable facilitator.

WORKING GROUPS The working group presents its preliminary results to conference attendees at a plenary.

Presentation Format of each contribution category	Presentation Format				
	Podium Presentation	Poster Presentation	Workshop	Roundtable	Working Group
Paper tracks:					
Engineering Education Research (EER)	•	•			
Advances in CDIO	•	•			
CDIO Implementation	•	•			
CDIO Projects in Progress	•	•			
Activities:					
Workshop			•		
Roundtable				•	
Working Group					•

WORKING GROUPS

The working group presents its preliminary results to conference attendees at the closing of the conference.

UPDATING CDIO SYLLABUS 3.0

Anders Rosén and Kristina Edström
KTH Royal Institute of Technology, Sweden
Johan Malmqvist and Ulrika Lundqvist
Chalmers University of Technology, Sweden

During the last decade, three major global developments motivate a new revision of the desired competences of graduating engineers; 1) Human driven degradation of ecosystems and the planetary system, such as climate change, are critical challenges for the survival of our civilization. 2) Digitalization is a key technology enabling engineers to address novel problems and existing problems in a much more effective. 3) There is also a perception that the pace of change has accelerated, which arguably renders engineering analysis different and requires decision-makers to continually be ready to reconsider. In addition, there is now extensive experience of the use and customization of the CDIO Syllabus within a widespread community. In particular, lessons learned from utilization for program and course development need to be taken care of. This working group thus aims to analyze the internal and external change drivers and use the findings to develop a revised CDIO Syllabus, the CDIO Syllabus 3.0.

TRANSLATING CDIO STANDARDS TO DIDACTICAL RECOMMENDATIONS IN ENGINEERING ETHICS EDUCATION

Gunter Bombaerts
Eindhoven University of Technology, the Netherlands
Sarah Junaid
Aston University, United Kingdom

Engineering ethics has become a fundamental part of engineering education frameworks across the globe. However the subject is often taught with a broad brush with ill-defined learning outcomes. Normative Ethics pervades every aspect of engineering from DFMEA and cost/benefit/risk analysis to professional responsibility in social environments to ethical and inclusive design. With ethics acknowledged as important, didactics are still underdeveloped. There is a great need to develop didactics. First step is to know where the main challenges are.

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ABOUT CDIO

The CDIO Initiative is an innovative educational framework for producing the next generation of engineers. The framework provides students with an education stressing engineering fundamentals set in the context of Conceiving — Designing— Implementing — Operating (CDIO) real-world systems and products. Throughout the world, CDIO Initiative collaborators have adopted CDIO as the framework of their curricular planning and outcome-based assessment. CDIO collaborators recognize that an engineering education is acquired over a long period and in a variety of institutions, and that educators in all parts of this spectrum can learn from practice elsewhere. The CDIO network therefore welcomes members in a diverse range of institutions ranging from research-led internationally acclaimed universities to local colleges dedicated to providing students with their initial grounding in engineering.

Vision of CDIO-based education provides an education that stresses the fundamentals, set in the context of Conceiving – Designing – Implementing – Operating systems and products:

- A curriculum organized around mutually supporting courses, but with CDIO activities highly interwoven
- Rich with student design-build-test projects
- Integrating learning of professional skills such as teamwork and communication
- Featuring active and experiential learning
- Constantly improved through quality assurance process with higher aims than accreditation

PREVIOUS CDIO CONFERENCES

2020 (16th)	Chalmers University of Technology, Gothenburg, Sweden (online)
2019 (15th)	Aarhus University, Aarhus, Denmark
2018 (14th)	Kanazawa Institute of Technology (KIT), Kanazawa, Japan
2017 (13th)	University of Calgary, Calgary, Canada
2016 (12th)	Turku University of Applied Sciences, Turku, Finland
2015 (11th)	Chengdu University of Information Technology, Chengdu, China
2014 (10th)	Universitat Politècnica de Catalunya, Barcelona, Spain
2013 (9th)	MIT-Harvard, Cambridge, USA
2012 (8th))	Queensland University of Technology, Brisbane, Australia
2011 (7th)	Technical University of Denmark, Lyngby, Denmark
2010 (6th)	École Polytechnique de Montreal. Montreal, Quebec, Canada
2009 (5th)	Singapore Polytechnic, Singapore
2008 (4th)	Hogeschool Gent, Gent, Belgium
2007 (3rd)	Massachusetts Institute of Technology, Cambridge, USA
2006 (2nd)	Linkoping University, Linkoping, Sweden
2005 (1st)	Queens University. Kingston, Ontario, Canada

ABOUT CHULALONGKORN UNIVERSITY

Founded in March 1917, Chulalongkorn University is Thailand's first institution of higher learning. The main mission of Chulalongkorn University is to be the center for academic learning and professional excellence. This is in line with the vision of the university's founder, King Rama VI, who established the university as a tribute to his father, King Rama V. Through the pursuit, development, dissemination and application of knowledge, Chulalongkorn University works to educate students with professional know-how and research skills, as well as preserve the arts, culture, and values. In addition to academic knowledge and learning, the university hopes to instill in students a sense of morality, social responsibility, and public service.

For more information, please visit https://www.chula.ac.th

ABOUT CHULA ENGINEER

Faculty of Engineering, Chulalongkorn University was founded in 1913, originally provided three-year education in engineering, which led to Diplomas in Engineering. In the 1930's three departments-Civil Engineering, Mechanical Engineering, and Electrical Engineering-were established and the university conferred its first Bachelor of Engineering degree in 1935. The faculty continued to expand to cover wider range of engineering disciplines. At present, the faculty has 12 departments; Civil, Electrical, Mechanical, Industrial, Mining and Petroleum, Survey, Environment, Metallurgical, Computer, Chemical, Water Resources, and Nuclear Technology. Also known as "Chula Engineer", the faculty has a vision to be the institution for educating engineers and initiating innovations. Chula engineering graduates portray integrity, intelligences, collaborations and adaptability through highly accredited curricula and state of the art researches and innovations.

For more information, please visit https://www.eng.chula.ac.th

ABOUT RMUTT

Rajamangala University of Technology Thanyaburi (RMUTT) was found in 1975 under the name of Institute of Technology and Vocational Education, then, became Rajamangala Institute of Technology in 1988. RMUTT is well established and has gained high recognition for its educational quality for over 40 years, and is part of the RMUTs network. RMUTT is the original and main campus of RMUTs and it sits on an area of 300 acre on Rangsit-Nakonnayok Road, Klong 6 Sub-district, Thanyaburi District, Patumthani Province, Thailand.

RMUTT maintains its original focus on quality teaching and instruction in science and technology and aims for high recognition from industry and organizations for its qualified graduates who are prepared and possess the needed knowledge and practical skills. RMUTT has 12 Faculties and 1 college that are responsible for offering four levels of educational programs in various disciplines: diploma programs in vocational education, Bachelor's Degree, Master's Degree and Doctoral Degree programs.

For more information, please visit http://www.eng.rmutt.ac.th/

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