

## Press release

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### 2022 Award in computer aided process engineering presented to two excellent young scientists

This year, the EFCE Excellence Award in Recognition of an Outstanding PhD Thesis on CAPE is presented to two laureates, **Dr. Alessandro Di Pretoro**, and **Dr. Ahmed Shokry Abdelaleem Taha Zied**.

The jury decided to share the Award among the two candidates due to the extraordinary and equally-high quality of their work and potential impact in scientific and industrial community.

**Alessandro Di Pretoro** obtained his B.Sc. in Industrial in Chemical Engineering from the University of Rome "La Sapienza", Italy, and his M.Sc. in Chemical Engineering from Politecnico di Milano, Italy. In 2022, he obtained a joint PhD in Industrial Chemistry and Chemical Engineering from Politecnico di Milano and in Process and Environmental Engineering from the Institut National Polytechnique de Toulouse, France. Currently, he holds the position of Associate Professor (Maître de Conférences) at INP de Toulouse – ENSIACET, Toulouse France.



The Award acknowledges his excellent PhD thesis on "*Optimal Design of Flexible, Operable and Sustainable Processes under Uncertainty: Biorefinery Applications*", elaborated during three years of joint PhD thesis programme between the Laboratoire de Génie Chimique INP-ENSIACET, Toulouse, France and Politecnico di Milano, Italy, under the co-supervisor of Professor Ludovic Montastruc and Professor Flavio Manenti.

The PhD thesis addresses the question of how process performances such as feasibility, profitability, sustainability etc., are affected when the operating conditions vary with respect to the nominal ones according which the process was designed and optimized. By means of both deterministic and stochastic flexibility indexes, the research work aimed at conceiving and revising the optimal design procedure of chemical processes by accounting for the impact of uncertainty on multiple optimization criteria. The main concern was to deal with the transition of chemical processes towards bio-based raw materials and sustainable energy sources whose nature and availability considerably fluctuates over the year seasons. A new switchability index has been proposed with the purpose to assess the ability of a system to switch from the nominal operating conditions to the perturbed ones accounting for its dynamic behaviour.

This innovative tool allows to compare different control strategies (PID vs MPC), control structures and tuning methodologies. Its effectiveness was proved on several process units such as CSTR and distillation columns.

Nominating him for the Award, Prof. Ludovic Montastruc said: "The PhD thesis work of Alessandro Di Pretoro represents a relevant contribution to the PSE domain for all those problems concerning systems design under perturbed conditions. Thanks to the innovative methodologies and tools proposed in this work further improvements in this field are possible even for other process systems and applications."

**Ahmed Shokry** obtained his B.Sc. in Industrial and Production Engineering and Master level 1 in Mechanical Design and Production Engineering in from Zagazig University, Egypt, and his Diploma of advanced studies -DEA- and PhD in Chemical Process Engineering from the Technical University of Catalonia, Spain. Currently, he holds the position of Research Engineer at the Center for Applied Mathematics, Ecole Polytechnique, Palaiseau, France. His research areas include Machine Learning (ML) and Artificial Intelligence (AI) applications for industrial processes management and precision agriculture.



The Award acknowledges his excellent PhD thesis on "*A Contribution to Chemical Process Operation Support: New Machine Learning and Surrogate Models-Based Approaches for Process Optimization, Supervision and Control*", completed at the Technical University of Catalonia, Barcelona, Spain, under the supervision of Professor Antonia Espuña.

This PhD thesis focuses on the improvement of the decision-making processes in the chemical industry, through the development of data-driven models (Machine Learning-ML) and solution methods able to consistently consider the different circumstances this decision-making should address, with different objectives and constraints, working together with other CAPE tools. In his thesis Ahmed Shokry developed a plateau of novel and efficient ML-based methodologies for supporting decision making at the main tasks/modules of process operation, in situations where either the process model is available but complex, or the process model is missing whereas sensor-measured data are available as the only source of information; together with software tools to achieve the automatic use and application of these methodologies.

Prof. Espuña said "The Thesis opened a new decision-making paradigm able to help organizations, to manage their supply chains in the presence of ill posed conditions with different objectives under uncertain complex situations, constituting an advance over the CAPE state-of-the-art, especially in terms of the scope of the proposed decision-support tools and solution approaches, and their flexibility."

Recommending him for the Award, Prof. Eric Moulines wrote: "The originality of the work stems from: - the highly innovative way in which classical AI, ML and optimization techniques are used and combined to develop novel methods to efficiently address existing challenges in chemical plant operations; - the wide range of process operation modules covered by the methods in the work, and; - the completely different behaviours of the process that the ML-based methods used were able to approximate and capture: continuous, discrete, static, dynamic, and, most importantly, optimal behaviour (i.e., optimal with respect to uncertain parameter changes)."

The 2022 Excellence Award in Recognition of an Outstanding PhD Thesis on CAPE is generously sponsored by the **Laboratoire de Génie Chimique - LGC**, Toulouse, France.



The award will be presented to Alessandro Di Pretoro and Ahmed Shokry on 13 June 2022, 10.30-11:30 AM CET, at the 32<sup>nd</sup> European Symposium on Computer Aided Process Engineering – ESCAPE-32 which will be held Toulouse, France, on 12-15 June 2022.

Ends

### **Related links**

EFCE media centre (<http://www.efce.info/News>)

EFCE Working Party on Computer Aided Process Engineering (<https://www.wp-cape.eu/>)

32<sup>nd</sup> European Symposium on Computer Aided Process Engineering – ESCAPE-32 (<https://escape32.inp-toulouse.fr/en/index.html>)

### **Notes to media**

For further information, please contact:

Claudia Flavell-While  
tel: +44 (0)1788 534422  
email: [Claudia@icheme.org](mailto:Claudia@icheme.org)

### **About chemical engineers**

Chemical, biochemical and process engineering is the application of science, maths and economics to the process of turning raw materials into everyday products. Professional chemical engineers design, construct and manage process operations all over the world. Oil and gas, pharmaceuticals, food and drink, synthetic fibres and clean drinking water are just some of the products where chemical engineering plays a central role.

### **About EFCE**

Founded in 1953, The European Federation of Chemical Engineering (EFCE) is a non-profit-making association, whose object is to promote co-operation in Europe between non-profit-making professional scientific and technical societies in 30 countries for the general advancement of chemical engineering and as a means of furthering the development of chemical engineering. See [www.efce.org](http://www.efce.org)

## About the sponsor

Interlinking Science and Technology, the **Laboratoire de Génie Chimique - LGC** participates in the latest advances in Chemical Engineering and develops experimental and theoretical research for new insights at the core of processes of transformation of matter and energy. LGC's mission is to produce knowledge in the field of Chemical Engineering by focussing on industrial and societal constraints and issues while participating in the international competition of new knowledge creation.

The Process System Engineering department aims to design interconnected equipment in a production unit. Its activity scans all the spatio-temporal scales from the molecule to the extended enterprise, including decision-making thanks to the concept of industrial engineering, the design of intensified equipment or even the integrated product-process design with molecular simulation.