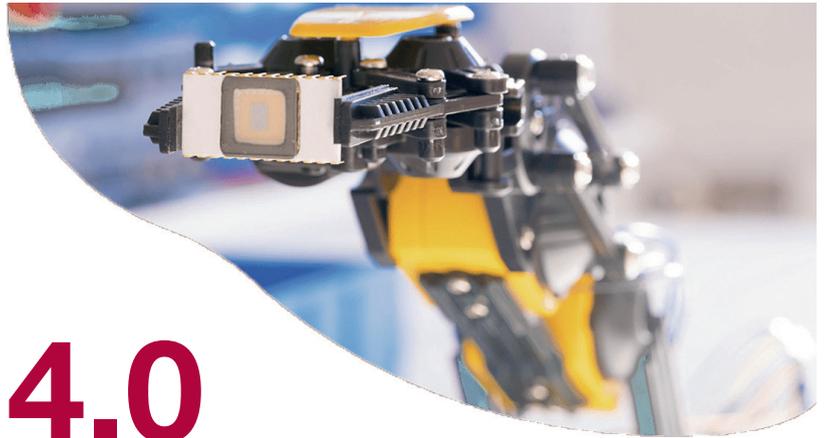




CentraleSupélec

# SUMMER SCHOOL Industry 4.0



1 - 12 July 2019

CentraleSupélec, Gif-sur-Yvette, France

<https://www.summerschoolcentralesupelec.fr/about/industry-4-0/>

In collaboration with

école  
normale  
supérieure  
paris-saclay



## Organizers



**Bernard Yannou** is a Professor in Design and Industrial Engineering in CentraleSupélec, Université Paris-Saclay. He is the head of LGI Industrial Engineering research department (Laboratoire Génie Industriel, <http://www.lgi.centralesupelec.fr/>)



**Christophe Tournier** is a Professor of Mechanical Engineering and Manufacturing in ENSPS (Ecole normale supérieure Paris-Saclay). He is the head of LURPA research department (Laboratoire Universitaire de Recherche en Production Automatisée, <http://lurpa.ens-paris-saclay.fr/>)

*Picture what Industry might be like in the future. CentraleSupélec and Ecole Normale Supérieure, Paris-Saclay will showcase disruptive Industry 4.0 technologies – automated production lines, operations 4.0, additive manufacturing, and collaborative robots – and fire your imagination on how today's companies must manage their transformation.*

We are looking for highly motivated, bachelor-level, international students to participate in this exciting summer school! We would be delighted to receive your application, including a dynamic cover letter.



## Professors:

Marc Alochét, Industry Expert, *Renault*  
Frédéric Amblard, Industry Expert, *CEA*  
Olivier Bruneau, Professor, *Université Paris-Sud*  
Mark Dean, Research Associate, *Flinders University*  
Andreas Hein, Research Associate, *CentraleSupélec*  
Claire Lartigue, Professor, *Université Paris-Sud*  
Sylvain Lavernhe, Associate Professor, *ENS Paris-Saclay*  
Julie Le Cardinal, Professor, *CentraleSupélec*  
Alain Patchong, Industry Expert, *Dillygence*  
Christophe Tournier, Professor, *ENS Paris-Saclay*  
Ludovic-Alexandre Vidal, Assistant Professor, *CentraleSupélec*  
Bernard Yannou, Professor, *CentraleSupélec*

# Summer School programme

For more information on the programme: <https://www.summerschoolcentralesupelec.fr/about/industry-4-0/>

Mon July 1, 2019	Tue July 2, 2019	Wed July 3, 2019	Thu July 4, 2019	Fri July 5, 2019
9:30 am - 12:00 pm Introductory Remarks <i>Bernard Yannou &amp; Christophe Tournier</i>	9:30 am - 12:00 pm Introduction to Machine Learning <i>Richard Combes</i>	9:30 am - 11:30 am Cultural Activity/Tour of the Campus	9:30 am - 12:00 pm Introduction to Industry 4.0 / Visit to the Factory <i>Julie Le Cardinal</i>	9:30 am - 12:00 pm Production Systems of the past and the future: Paradigm shift and concepts <i>Alain Patchong</i>
1:30 pm - 4:30 pm Understanding production management systems by serious gaming <i>Ludovic-Alexandre Vidal</i>	1:30 pm - 4:30 pm Introduction to Industry <i>Julie Le Cardinal</i>	2:00 pm - 6:00 pm Visit of the BCG Innovation Center for Operations	1:30 pm - 4:30 pm Automotive Industry and Industry 4.0 <i>Marc Alochet</i>	1:30 pm - 4:30 pm The Factory Lab Industry 4.0 technology incubator <i>Frédéric Amblard</i>

Mon July 8, 2019	Tue July 9, 2019	Wed July 10, 2019	Thu July 11, 2019	Fri July 12, 2019
9:30 am - 12:00 pm Challenge Preparation <i>Andreas Hein</i>	9:30 am - 12:00 pm The Human Dimensions of Industry 4.0 – Guest Lecture <i>Mark Dean</i>	9:30 am - 12:00 pm Contactless scanning and point cloud processing <i>Claire Lartigue</i>	9:30 am - 12:00 pm Performance of robots and models for digital twin – Practicals <i>Olivier Bruneau</i>	9:30 am - 12:00 pm Challenge <i>Andreas Hein</i>
1:30 pm - 4:00 pm Additive manufacturing by laser bed melting <i>Christophe Tournier</i>	1:30 pm - 4:30 pm Roundtable	1:30 pm - 4:30 pm Cultural Acitivity	1:30 pm - 4:00 pm Performance of robots and models for digital twin <i>Sylvain Lavernhe</i>	1:30 pm - 4:30 pm Farewell Cocktail

## Summer School special activities

**Visit to the BCG Innovation Centre for Operations:** ICO is a model factory that aims to accelerate digital transformation in leading companies across a wide range of industries.

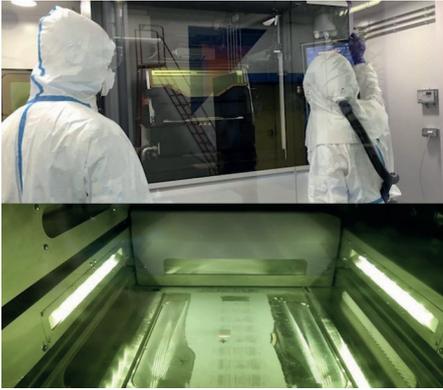
During the visit, students will be able to experiment with cutting-edge technological tools such as advanced robotics, data analytics, 3D printing, augmented reality, the industrial Internet, and a simulation platform.



### Introducing production management methods and stakes through serious gaming

Understanding Industry 4.0 stakes requires grasping the basics of production management systems. This is what this lecture aims to do by using Lego serious games. Attendees will design two car assembly lines and produce colored car Lego structures with customized options. Two conventional production management methods will be used – MRP and Kanban – to simulate the production process. But, just like in real life, some defects and incidents can occur. This two-hour experience will teach students the basics of production performances.

## Discovering sophisticated additive manufacturing



Additive Manufacturing (AM) is a technological revolution in the design and manufacture of components and industrial systems. After a presentation of the process and simulation activities, participants will be led into the laser belt melting additive manufacturing cell to observe the production implementation and discover the safety constraints of metal powder-based processes.

## Performance of robots and models for digital twin

Despite certain advantages such as speed of execution, accessibility and manipulability, industrial robots exhibit structural defects resulting in inaccurate positioning due to geometrical manufacturing errors, elastic deformations (parts, joints) under kinematic and dynamic loads.

Within the context of smart manufacturing, which calls for an integrated production line solution with short cycle times and compatible with automated production, methods of modelling, identification and control will be proposed to improve the performance of robots and collaborative robots.

The practical objective is experimenting several trajectories on a 6-axis robot from Universal Robot and comparing them to simulations from a model to build, based on the rigid multibody theory, in order to predict actuators torques.



## Your challenge: Designing a production system for a Martian settlement



In groups of three, you will play the role of pioneers to Mars in a serious game.

Picture it – human settlers on Mars. Just a fantasy? Not at all! Companies such as SpaceX are tackling the challenge of constructing a settlement on Mars within the next 20 years. A Mars settlement would exist in a much more highly resource-constrained and dangerous environment than anywhere on Earth. On Mars, everything must be either created – consumables, spare parts, and goods – or imported from Earth, which will take almost a year. Embark on the unique opportunity to design a production system on Mars, supplying the first settlers with what they need to survive. You will learn how

to design a system based on key technologies of Industry 4.0 in an exciting new context.

## Additional activities



In addition to attending classes and lectures, participants will get the chance to tour Paris with a professional guide and see some of its most renowned tourist spots. They will also visit research and industrial facilities located in the fast-growing Paris-Saclay industrial and technological cluster, dubbed the “French Silicon Valley”.

**Cultural Programme:** The cultural programme includes: guided visits of the Musée des Arts et Métiers & of the Musée de l’Orangerie, a walking tour in downtown Paris, and a cruise on the Seine, in Paris’s famous Bateaux mouches.



# Practical Information

**For more information on the programme:** <https://www.summerschoolcentralesupelec.fr/about/industry-4-0/>

**For more information on tuition fees and accommodation:** <https://www.summerschoolcentralesupelec.fr/about/practical-information-campus-life/>

**For the registration form:**

<https://www.summerschoolcentralesupelec.fr/registration/>

**Eligibility:** 3rd or 4th year Bachelor's programme, 1st year Master's programme in Engineering or Science.

**Tuition Fees:** €1,800 (Fees include: courses & activities; accommodation; two-week pass for public transportation)

**Deadline:** 27 May 2019

## Accommodation

Student residence Campuséa Paris Palaiseau

Address: 26-28 route de Saclay – 91120 Palaiseau

Participants will live in a modern student residence located in a new eco-neighbourhood Camille Claudel, in the heart of a student area – 40 minutes from Paris.

Included facilities:

Wifi

Linen kit (bed sheets, towels, etc.)

Kitchen kit (plates, cutlery, pan, etc.)

Access to fitness, lounge hall, etc.



<https://www.campusea.fr/fr/residence-etudiante-paris-palaiseau/residence-etudiante>

## CentraleSupélec and Paris Saclay

CentraleSupélec is one of the most prestigious French engineering schools. Its excellence lies in its mix of fundamental and applied sciences and in the importance attached to innovation.

CentraleSupélec is one of the driving forces behind the Université Paris-Saclay project. The project, launched in 2015, aims at creating a research-intensive academic campus and business cluster on the Saclay Plateau, 25 km south of Paris. On our campus, students will find all sport & leisure facilities.

You can reach the Paris-Saclay campus by taking the following buses from three RER B stations (Massy-Palaiseau, Lozère and Le Guichet): 91.06B, 91.06C and 9, get off at the stop called “Moulon”.



**Contact:** [summerschool@centralesupelec.fr](mailto:summerschool@centralesupelec.fr)