CI-LAM Summer School
"The future of tech-X"

Spurring the next generation talents for advanced manufacturing

CI-LAM
China - Italy
Joint
Laboratory
on Advanced
Manufacturing

中意先进制造联合实验室

The China-Italy Lab on Advanced Manufacturing is a bilateral platform established in 2017 to promote and enhance the results of a joint cutting-edge research and development within the field of Advanced and Smart Manufacturing. CI-LAM pools the resources of enterprises and research institutions to carry out application-oriented joint R&D and product innovation, helping manufacturing stakeholders in both countries – SMEs and start-ups in particular – adopt the new industrial paradigms and technologies.

THE CI-LAM SUMMER SCHOOL

The 2020 edition of the CI-LAM Summer School program has been totally digitalised and transformed in an online training, innovation and matchmaking activity. The Summer School will be held twice a week and will last for four weeks starting from mid-July 2020.
This second edition will involve primarily students from University of Bergamo, University of Naples, Tsinghua University but will be also enlarged to students from other Italian and Chinese universities.
The attendance will be limited to a maximum number of 100 students.

Each lecture will last 2 hours. After each lecture, researchers interested on the topic will have the opportunity to discuss in a R&D matchmaking session about possible bilateral joint research cooperation.
At the end of the School the students will receive a "Certificate of Attendance", issued by CI-LAM with the endorsement of the three academic organising institutions.

Further information can be found on the website
www.cilam.org

The program

Time	Topics	Lecturer
July 13th Italy: 10:00-11:00, China: 16:00-17:00	**Inauguration of the CI-LAM Summer School**	CI-LAM Faculty
July 14th Italy: 9:00-11:00, China: 15:00-17:00	**Future Communication Networks: The role of quantum internet**	Prof. Cacciapuoti Prof. Caleffi Federico II
July 16/7 Italy: 9:00-11:00 China: 15:00-17:00	**Development and application of Power Electronic Technology**	Prof. Xi Xiao Tsinghua
July 21/7 Italy: 9:00-11:00 China: 15:00-17:00	**Optical imaging and sensing technology**	Prof. Liangcai Cao Tsinghua
July 23/7 Italy: 9:00-11:00 China: 15:00-17:00	**Service Optimization and Control in 5G**	Prof. Tulino Federico II
		Dr. LLorca New York University
July 27/7 Italy: 9:00-11:00 China: 15:00-17:00	Robotics and Industrial Automation	Jason Wang China Sci-Tech Automation Alliance
July 31/7 Italy: 9:00-11:00 China: 15:00-17:00	**Mechatronics System Design**	Prof. Righettini UNIBG
Aug 4/8 Italy: 9:00-11:00 China: 15:00-17:00	Additive manufacturing	Prof. Peng Wen Tsinghua
Aug 7/8 Italy: 9:00-11:00 China: 15:00-17:00	**Cybersecurity and Information Security Core Concepts**	Prof. Paraboschi UNIBG

All the contents will be in English.

Short abstracts of the lectures

Future Communications Networks: The role of the Quantum Internet
The Quantum Internet is governed by the laws of quantum mechanics. Phenomena with no counterpart in classical networks, such as no-cloning, quantum measurement, entanglement, impose very challenging constraints for the network design. Specifically, classical network functionalities, ranging from error-control mechanisms to overhead-control strategies, are based on the assumption that classical information can be safely read and copied. But this assumption does not hold in the Quantum Internet. As a consequence, the design of the Quantum Internet requires a major network-paradigm shift to harness the quantum mechanics specificities. The aim of this webinar is to highlight the challenges and the opportunities connected to the design and deployment of the Quantum Internet from a communication engineering perspective.

Development and Application of Power Electronic Technology
Power electronics is the key technology of modern power conversion, which has been widely used in power system, advanced manufacturing, electrified transportation and other fields. This lecture will focus on the power electronics technology in motor drive, motion control and renewable energy generation, including the high performance and high dynamic response control method of motor, the high precision trajectory drive technology of robot, the high efficiency power conversion technology in energy storage system and wave power generation system, and so on. Finally, the lecture will also introduce the hot issues and cutting-edge technologies of power electronic devices, topology and control strategies.

Optical imaging and sensing technology
This course provides a broad overview of optical sensing and imaging principles and techniques for advanced manufacturing applications, as well as on the generic uses of sensors and cameras for our daily lives. The ongoing status and trends in sensing and imaging will be presented for high resolution, low cost, smart devices in the fields of microscope, cell phone, autonomous driving, machine vision, and so on. The basic optics will be introduced including numerical aperture, imaging resolution, depth of focus, field of view, and so on. Typical optical sensors, detectors, modulators and filters will be introduced for various imaging systems. A brief overview will also be given on computational imaging with cutting-edge components, algorithms, and systems for scientific research and industrial applications.

Service Optimization and Control in 5G
5G networks are envisioned to support a wide range of services with diverse performance requirements over a common physical infrastructure. Such services go beyond traditional communication services that deal with the efficient delivery of information from sources to destinations, and involve the real-time processing of source streams via possibly multiple functions that can be executed at different compute-enabled network locations. Examples include augmented experience services such as virtual/augmented reality, immersive video, and telepresence, as well as automation services such as smart homes/buildings/cities, industrial automation, and autonomous transportation. This chapter covers recent advances around the design of algorithms and protocols for the end-to-end optimization and dynamic control of real-time computation services over cloud-integrated 5G networks.

A new multi-commodity-chain (MCC) flow model, shown to generalize traditional multi-commodity flow by including flow chaining, flow scaling, and joint communication/computation resource allocation, is introduced.
Building on the MCC model, we describe how to characterize the capacity of distributed computing networks and present throughput-optimal algorithms that jointly schedule computation and communication resources in order to drive the real-time processing of network flows through the appropriate sequence of service functions, before being delivered to the corresponding destinations.

Robotics and industrial automation
Basic concepts, principals and key enabling technics of automation and robotics, as well as their crucial roles in modern manufacturing system are introduced. The past, today and future of technical and product development routes is illustrated. Some new requirements arisen from smart manufacturing/I4.0/Industrial Internet and future application scenarios are identified. Finally, state of the art products and their innovative applications are shown.

Mechatronics System Design
The webinar proposes a comprehensive presentation of the motion control through the field bus communication network.
The performances and the quality of the motion generated using this approach depends on all the components involved: the power drive system configuration, the field bus communication network used and the software interface mapping the power drive system into the control device.
The main topics are: the industrial and the international standard reference solution of the power drive systems regarding the control and to the communication capabilities; the international standard reference of the field bus technologies enabling motion control over field bus like modern real-time Ethernet solutions; motion control quality of multi-axis machinery as a function of the network communication technologies, power drive system configuration and the software interface chosen.

Additive manufacturing
Additive manufacturing (AM), commonly known as 3D printing, is a revolutionary technology to the research and industry due to its adaptation to free design and various materials, which significantly lower the technical difficulty, time and cost to produce customized parts and becomes a powerful tool to many research activities. In this lecture, we will introduce the fundamental theory, technical development, and key scientific issues of AM technologies with emphasis on the AM of metals. The main contents include: 1. the birth of AM; 2. current AM technologies; 3. Materials aspects; 4. Function oriented AM design; 5. Processing control; 6. a typical AM example for customized medical implants; 7. Future perspectives; 8. Discussion: what is your idea to AM.

Cyber-security and Information Security Core Concepts
Computer Security is an increasingly important topic, with an impact on many industrial and research domains. This lecture will present the core concepts that underlie the technologies used in this area. The Confidentiality-Integrity Availability paradigm will be described, looking at the main aspects that have to be taken into account in the implementation of each of the services. A concise classification of the main cryptographic primitives will be provided. A perspective on the evolution of this field will be offered.