Alex Upellini

Mathematica for teaching and research in fundamental and applied sciences

Speaker
Alex Upellini

Mario Veruete obtained his Ph.D. in Applied Mathematics from the University of Montpellier in 2019. He was an Associate Professor in Applied Mathematics at the EPF Ecole d'Ingénieures from 2019-2020. He started using Mathematica in 2007 and has used it ever since in research and development. The Wolfram Language has been present at each step of his research, from quantum computing and machine learning to finance modeling and data science. In addition, he uses Wolfram System Modeler for optimal control of dynamical systems. Veruete has a great deal of experience as a technical consultant for different industries using Wolfram technologies. Last but not least, the Wolfram Language enables him to present mathematical concepts to his students in a powerful and highly interactive way. Founded by Stephen Wolfram in 1987, Wolfram Research is one of the world's most respected computer, web and cloud software companies—as well as a powerhouse of scientific and technical innovation. As a pioneer in computation and computational knowledge, we have pursued a long-term vision to develop the science, technology and tools to make computation an ever-more-potent force in today's and tomorrow's world.

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Topics

Introduction to Mathematica (60 minutes)

This module allows you to familiarize yourself with the interface and the language of Mathematica. You will learn how to perform your first calculations; fundamentals of syntax, functions, evaluations of the Wolfram Language; make assignments; define functions. You will discover Mathematica numbers and precision, algebraic manipulation, solving equations, calculation functions, numerical and symbolic calculations, interpolation.

Solving PDEs, ODEs and DAEs (45 minutes)

This module covers techniques for solving ordinary differential equations (ODEs), algebraic differential equations (DAEs) and partial differential equations (PDEs). We will introduce you to the Wolfram language DSolve built-in function for finding symbolic solutions to differential equations and the NDSolve built-in function, a numerical differential equation solver. Topics covered: numerical method of lines (MOL), boundary conditions, finite element method (FEM) and the use and construction of meshes.

Data Science, data visualisation and Machine Learning and Image processing (45 minutes)

Build your data science process around insightful questions rather than limited traditional methods. This course teaches how to work with data in various formats, turn raw data into clean, computable datasets and perform preliminary explorations.

Data is all around us, and methods of making sense of data are only becoming more important. This course introduces a visual, example-driven approach to learning the process of data science. Through built-in knowledge in the Wolfram Language, a dozen extensive and applicable explorations are carried out, with visualization guiding the way. Leverage the richness of the Wolfram Language's curated data and a plethora of data visualization functions to discover a revolutionary new way of doing data science: localized, organized and extensive.

Make cutting-edge image processing simple with the Wolfram Language. Learn the fundamentals of digital image processing, including image representation and classical operations on images. This course emphasizes practical applications and understandable explanations of how image operations work. Numerous examples are included to illustrate standard applications.

Q&A session (10/15 minutes)

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Instructions

Note that in order to make the session more interactive and give the audience a chance to manipulate the software during the session with the instructor, we encourage attendees to come with their own laptop equipped with Mathematica (Version 13.0.1). We will alos provide them with the course material on the day.
They can download a trial version of Mathematica (Desktop) and/or create an account at Mathematica Online (Cloud) valid for 15 days:

https://www.wolfram.com/mathematica/trial/