



The dept. of Excellence DII organizes a short course for PhD in Industrial Engineering  
at Federico II on

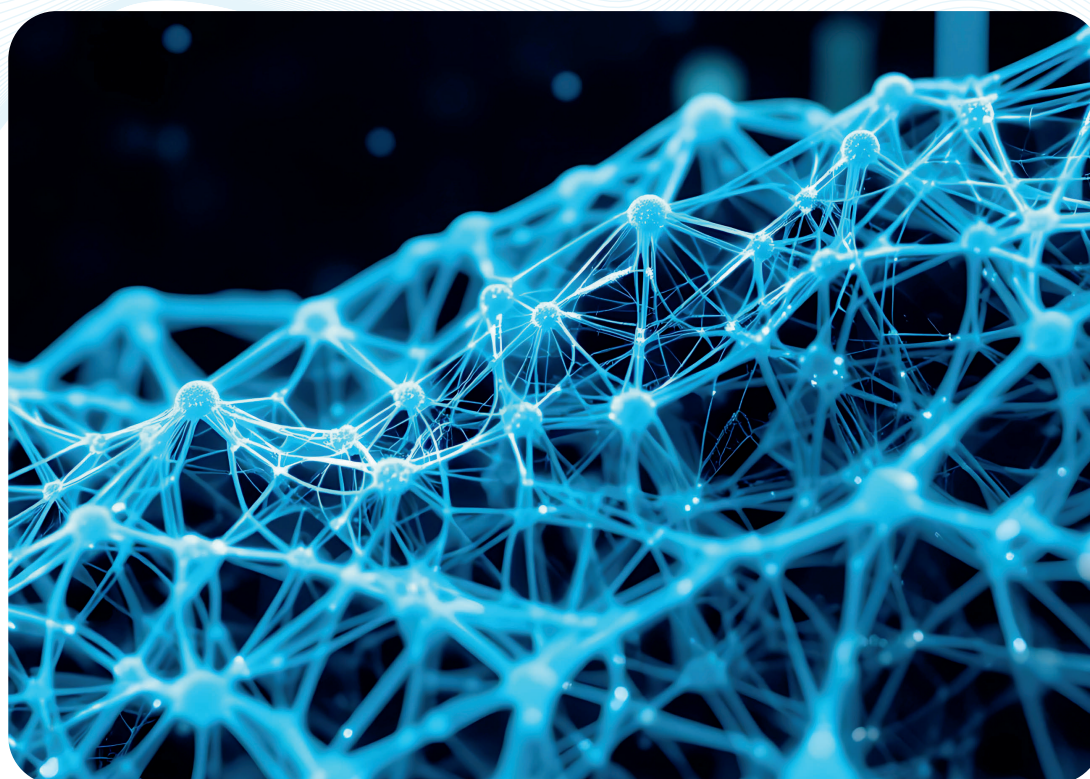
## **All Models are Uncertain**

Prof. **Gianluca Iaccarino**

Bosch Chair and Professor in Mechanical Engineering Department at Stanford University

**May, 5th - 9th, 2025**

Scuola Politecnica e delle Scienze di Base



### Course Contents

In the last four decades, **computer simulation tools** have achieved wide spread use in the **design** and **analysis of engineering devices**, leading to a reduction of physical prototyping and to lower costs.

In spite of this considerable success, it remains difficult to provide objective confidence levels in quantitative information **obtained from numerical predictions**. The complexity arises from the amount of uncertainties related to the inputs of any computation attempting to **represent a physical system**. Rigorous **quantification of the uncertainties** introduced in numerical simulations **is required** to establish objectively their **predictive capabilities**.

I will describe **different strategies used for quantify uncertainties in engineering applications**.



### Invited Lecturer



Prof. **Gianluca Iaccarino**

#### **Career:**

Gianluca Iaccarino is the Bosch Chair and Professor in Mechanical Engineering Department at Stanford University. He received his PhD in Italy from the Politecnico di Bari in 2005 and has worked for several years at the Center for Turbulence Research (NASA Ames & Stanford) before joining the faculty at Stanford in 2007. Since 2014, he is the Director of the PSAAP Center at Stanford, funded by the US Department of Energy: a large research Center focused on multiphysics simulations, uncertainty quantification and exascale computing. In 2010, he received the Presidential Early Career Award for Scientists and Engineers (PECASE) award from the President Obama, for his work on uncertainty quantification in computational science. In the last few years, he has received best paper awards from AIAA, ASME IMECE and Turbo Expo Conferences. He is a fellow of the APS and associate fellow of AIAA.

⚠ To participate in the course please follow the instructions on the last page



## Detailed Course Programme

### All Models are Uncertain

#### Monday

**May 5th, 2025**

**Aula DII, X Floor,  
Piazzale Tecchio, 80**

Introduction to the Course from:

Prof. **Renato Tognaccini**, Full Professor at the SPSB

9:00-13:00: **First lecture:**

- Setting the stage: What is a model? What is uncertainty? The path towards credible predictions
- Curiosity and Skepticism: a Healthy Mindset
- The Modeling Process

14:00-16:00: **Self-guided Activity #1**

- Grammar of Model Analysis - py-grama

#### Tuesday

**May 6th, 2025**

**Aula DII, X Floor,  
Piazzale Tecchio, 80**

9:00-13:00: **Second lecture:**

- Conceptual Tools for Handling Uncertainty
- Examples through Case Study
- Formulating your own Case Study

14:00-16:00: **Self-guided Activity #2**

- Define your own Case Study - target a self contained python code

#### Wednesday

**May 7th, 2025**

**Aula DII, X Floor,  
Piazzale Tecchio, 80**

9:00-13:00: **Third lecture:**

- Mathematical and Statistical Tools
- Modeling Uncertainty
- Foundations of Uncertainty Propagation
- Sampling Techniques

14:00-18:00: **Self-guided Activity #3**

- Uncertainty Analysis in your Case Study

#### Friday

**May 9th, 2025**

**Aula DII, X Floor,  
Piazzale Tecchio, 80**

9:00-11:00: **Fourth lecture:**

- Advanced Tools in Uncertainty Analysis

11:00-13:00: **Shotgun Presentations**


- 5 min discussions of each self-directed project


### Additional Info

The official languages will be English.

The participation to the Course will give to:

- **PhD students** the right to **3 CFU**.

 **To attend the Course please send an email to the professor Renato Tognaccini** [CLICK HERE](#)

 Excellence Seminar Secretary: Paola Muratto [paola.muratto@unina.it](mailto:paola.muratto@unina.it) and Luigi Calvanese [luigi.calvanese@unina.it](mailto:luigi.calvanese@unina.it)

### Acknowledgements

Department of Industrial Engineering (DII) was appointed as Department of Excellence over the period 2023-2027 with a project funded by MUR (Italian Ministry of University and Research). DII thanks MUR for funding the Visiting professorship program among the activities of the Department of Excellence.