



UNIVERSITÀ DI PISA
DIPARTIMENTO DI INGEGNERIA DELL'INFORMAZIONE
Dottorato di Ricerca in Ingegneria dell'Informazione

Doctoral Course

**“A practical guide to advanced computer aided modelling for
information engineers”**

Dr. Chiara Magliaro

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Short Abstract :

The course aims at introducing the students to the physics and multi-physics based modelling, focusing on applications in the field of information engineering, in particular biomedical ones. The first part of the course will provide basic abilities of using COMSOL Multi-physics software for modelling physical phenomena, in particular transport and reaction of chemical species, heat transfer and solid mechanics. Then, the second part of the course will be devoted to hands-on using the software, identifying exercises close to the activities of the students during their PhD experience.

Course Contents in brief:

- Brief introduction to Physics and Multi-Physics modelling and to the COMSOL platform
- Definition of easy and complex geometries and meshing
- Parametric sweep solutions
- “Transport and reaction of chemical species”, “heat transfer” and “solid mechanics” modules
- Data handling: post-processing and plotting
- Examples and applications

Total # of hours of lecture: 12

References:

[1] Magliaro C, Rinaldo A, Ahluwalia A. 2019. Allometric Scaling of physiologically-relevant organoids. Sci Rep 559682

CV of the Teacher

Chiara Magliaro is a biomedical engineer. She got her PhD with honors in 2016. For the high quality of her work, she also got the certification for the European Doctorate (Doctor Europaeus), and the award for the best Italian PhD Thesis (premio Massimo Grattarola). She won for two years the Fondazione Umberto Veronesi Post-Doctoral Fellowship, in 2018 and 2019. Actually, she is a post-Doc researcher at the Research Center "E. Piaggio".

Main research focus:

1. Development of open-source imaging methods for tissue processing, single neuron segmentation and 3D morphometric extraction from confocal/two-photon datasets representing densely-packed neurons in their native arrangement within the brain. The quantitative morphological analysis of the micro-structure could be useful to better understand the structure-function relationship within the brain.
2. Multi-physics and physics-based modelling of nutrient transport and diffusion in engineered *in vitro* constructs. The real-time monitoring of cellular behaviour in *in vitro* constructs at different complexity (from traditional monolayers, up to cell-laden spheroids and organoids) is crucial for defining quantitative metrics and determining the physiological relevance of engineered constructs.

Actually, she is the co-coordinator of the Human Brain Project Partnering project [SENSEI](#). She also joins the [Simply Neuroscience APAP Program](#) as an advisor for young international students in neuroscience and neuroengineering.

Room and Schedule

Room: *Aula Riunioni del Dipartimento di Ingegneria dell'Informazione, Via G. Caruso 16, Pisa – Ground Floor.*

Schedule:

Day1: December 6th, 15.00-18.00 (3h)

Day2 – December 7th, 10.00-13.00 (3h)

Day3 – December 9th, 10.00-13.00 (3h)

Day 4 – December 10th, 10.00-13.00 (3h)