



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

Doctoral Course

“Integrated Photonics for Communications: passive devices”

Prof. Nicola Andriolli
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Short Abstract: This course will introduce integrated optical devices and circuits for communications. Emphasis will be on the simulation and design of Silicon-based passive integrated devices (e. g., splitters/couplers, edge and grating couplers), exploiting both analytic and numerical techniques. Front lectures will be complemented with exercises using MATLAB and Tidy3D software.

Course Contents in brief:

- Introduction to integrated photonics
- Waveguide design
 - o Slab waveguide
 - o Rectangular waveguide
- Numerical tools for photonic integrated circuits
 - o Mode solver
 - o FDTD
- Couplers and splitters
- Optical I/O
 - o Grating coupler
 - o Edge coupler

Total # of hours of lecture: 16 hours

References:

1. C. Pollock, M. Lipson, “Integrated Photonics,” Springer.
 2. G. Lifante, “Integrated Photonics: Fundamentals,” Wiley.
 3. L. Chrostowski, M. Hochberg, “Silicon Photonics Design: From Devices to Systems”, Cambridge University Press.
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CV of the Teacher

Nicola Andriolli received the Laurea degree in telecommunications engineering from the University of Pisa in 2002, and the Diploma and Ph.D. degrees from Scuola Superiore Sant'Anna, Pisa, in 2003 and 2006, respectively. He was a Visiting Student at DTU, Copenhagen, Denmark and a Guest Researcher at NICT, Tokyo, Japan. In 2007-2019 he was an Assistant Professor at Scuola Superiore Sant'Anna, in 2019-2023 he was with the National Research Council of Italy as a Researcher and then Senior Researcher at the Institute of Electronics, Information Engineering and Telecommunications (CNR-IEIIT). Since 2024 he is an Associate Professor in Telecommunications at the University of Pisa at the Department of Information Engineering.

He has a background in the design and the performance analysis of optical circuit-switched and packet-switched networks and nodes. His research interests include photonic integration technologies for telecom, datacom and computing applications. He has been working in the field of optical processing and optical interconnection network architectures and scheduling, and more recently has been investigating integrated transceivers, comb sources, and architectures and subsystems for photonic neural networks.

He has advised several BS, MS, and PhD students, and taught courses on Network Software, Design of Access, Metro and Core Networks, Interconnection Networks, Data Center Networks, Photonic Integrated Circuits, Photonics Laboratory, Random Signals, Digital Communications, Optics for 5G.

He has authored more than 200 publications in international journals and conferences, contributed to one IETF RFC, and filed 11 patents. He has been a TPC Member in several international conferences (ICC, GLOBECOM, ECOC, EuCNC, IPR, PSC), he served as an Associate Editor of IEEE Access between 2019 and 2022, and he is an Associate Editor of IEEE Photonics Journal.

Final Exam: Oral dissertation on theoretical and simulative aspects discussed during the course.

Room and Schedule

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

Schedule:

17/12/2025:	08:30-12:30
18/12/2025:	08:30-12:30
22/01/2026:	14:30-18:30
23/01/2026:	08:30-12:30

The course is in the framework of the educational activities of IEEE Student Branch at the University of Pisa

