Lecture course type: Seminars - Academic Year 2020/21

Period: I or II Semester

Title: Integrated Photonics Laboratory – PIXAPP Advanced Integrated Photonic Education Program

Teacher: Dr. Francesco Floris (email: francesco.floris@tyndall.ie)

Level: Master Degree and Ph.D.

Credits: 3 (1+2)

Contents:

MODULE I (1CFU) [25h] - Computational Integrated Photonics

1. Study [10h]:
    a. Appendix D "Computational Photonics" of Joannopoulos [2.5h];
    b. Chapter 7 "Periodic Dielectric Waveguides" of Joannopoulos [2.5h];
    c. Chapter 8 "Photonic-Crystal Slab" of Joannopoulos [2.5h];
    d. Chapter 9 "Photonic-Crystal Fibers" of Joannopoulos [2.5h];
2. Exercises on the previous chapters [15h]:
    a. Using Matlab or Python create a code to evaluate the effective refractive index of a Silicon (n=3,48) waveguide with thickness varying from 10nm to 500nm at λ=1,55μm [5h];
    b. Using Matlab or Python create a code based on the Integral Overlap to evaluate the Edge-coupling between two SMF-28 fibers [5h];
    c. Using Matlab or Python create T-matrix code to calculate the stop band centered at λ=1,55μm of a Distributer Bragg Reflector (DBR) [5h];

MODULE II (2CFU) [50h] - Designing Advanced Photonic Integrated Circuits Building-blocks

1. Study [10h]:
    a. Chapter 10 "Designing Photonic Crystals for Applications" of Joannopoulos [10h];
2. Exercises on the previous chapters [40h]:
    a. Design a waveguide in Silicon (n=3,48) for λ=1,55μm, width=0,45μm and high=0.22μm and Evaluate the losses in $dB \cdot cm^{-1}$ [15h];
    b. Design a bend for the waveguide already optimized in previous point (2.a.) and Optimize the radius of curvature and calculate the consequent losses in $dB \cdot cm^{-1}$ [10h];
    c. Design a standard grating coupler made in Silicon (n=3,48) and tuned at λ=1,55μm for the waveguide already optimized in previous point (2.a.) and Evaluate pitch, etch-depth and duty-cycle [15h].

Text: Joannopoulos - Photonic Crystals: Molding the Flow of Light
(available for free at http://ab-initio.mit.edu/book/)