

interferometer (MMI), grating coupler. (2 sessions)

- Filter design: How do wavelength filters work? Different types of filters (IIR, FIR) and implementations (arrayed waveguide grating, Echelle grating, MZI, ...). Synthesize an optical filter from functional requirements. (1 session)
- From Component to Circuits: Surrogate and compact models. Different ways to describe components (frequency/time domain). Defining relevant models, choosing parameters and typical pitfalls. Hands-on constructing a model description for a component, building up complexity (dispersion, parasitics, ...). (1 session)
- Optimizations: different ways to optimize a component: numerical, surrogate model based, or experimental. Includes basics of DOE. Application in designing a component or small subcircuit. (1 session)
- Design for manufacturability: Concepts of design rules and verifications, impact of lithography processes on components and circuits. Different types of variability (Wafer-to-wafer, intra-wafer and intra-die) and their causes. Corner analysis and yield prediction using monte-carlo circuit simulations. Approaches to tolerant designs (robust optimization, passive compensation). (1 session)
- Measurement and data-analysis: Basic measurement principles (but no hands-on-measurement). Measurement errors and variability. Fitting and parameter extraction. Apply on the measurements of the fabricated devices. (1 session)
- Applications: What are photonic integrated circuits used for? What are the different boundary conditions for the various applications in communications, sensing, measurement techniques etc. ? (1 session)

Initial competences

- Electromagnetics;
- Course of Microphotronics: understanding of optical waveguides and waveguiding components (directional couplers, taper, splitter), basic simulation methods.

Final competences

- 1 Understanding of the PIC design flow and tape-out flow and the potential obstacles.
- 2 Understand different simulation techniques and know which problems to apply them to.
- 3 Design basic integrated optical filters from functional specifications.
- 4 Understanding of nonidealities in photonic chips and circuits.
- 5 Generate correct mask files for an optical chip.

Conditions for credit contract

Access to this course unit via a credit contract is determined after successful competences assessment

Conditions for exam contract

This course unit cannot be taken via an exam contract

Teaching methods

Seminar, Lecture, Independent work

Extra information on the teaching methods

Lectures, coached exercises, and a design project where the student designs a small photonic circuit. this will be fabricated and characterized, after which the performance can be compared to the original design.

Study material

None

References

Course content-related study coaching

Assessment moments

end-of-term and continuous assessment

Examination methods in case of periodic assessment during the first examination period

Oral assessment, Written assessment

Examination methods in case of periodic assessment during the second examination period

Oral assessment, Written assessment

Examination methods in case of permanent assessment

Assignment

Possibilities of retake in case of permanent assessment

examination during the second examination period is possible in modified form

Extra information on the examination methods

- End of term examination (written and oral)
- Continuous assessment (exercises, report)

Calculation of the examination mark

50% on exercises and autonomous work (design of a chip);
50% on end of term examination.