Proposed Syllabus for *Electronic Photonic Design Automation*

Course Description:
This course delves into the increasing complexity of photonics integration and the urgent need for a comprehensive ecosystem of design tools and methodologies at the device, circuit, and system levels. As the photonics and traditional electronic design communities collaborate to develop various tools and methodologies, there remains a gap in fully addressing the needs of integrated photonics design. This course will provide an in-depth exploration of Electronic Photonic Design Automation (EPDA) tools, methodologies, and their applications in photonic device, circuit, and system design. Students will gain comprehensive knowledge and hands-on experience with integrated photonics design tools used in real-world design projects.

Textbooks and References:
The course does not rely on a single textbook. Reading material will be given, drawn from research articles and book chapters, in addition to the following reference books:

1. *Design Flow Automation for Silicon Photonics: Challenges, Collaboration, and Standardization – Chapter of Silicon Photonics III*
   Mitchell Heins, Chris Cone, John Ferguson, Ruping Cao, James Pond, Jackson Klein, Twan Korthorst, Arjen Bakker, Remco Stoffer, Martin Fiers, Amit Khanna, Wim Bogaerts, Pieter Dumon, and Kevin Nesmith
2. *Introduction to Layout Design and Automation of Photonic Integrated Circuits*
   Ahmadreza Farsaei
3. *Principles of Photonic Integrated Circuits*
   Richard Osgood jr. and Xiang Meng

Course Components:

1. Class participation (20%)
2. Literature review presentations (2x) (20% each)
3. Course project (40%)

Lecture Schedule:

1. Evolution of integrated photonics, overview of EDA, and the need for EPDA
2. Photonic device design foundations: tools and methodologies
3. Photonic device design optimization: techniques and challenges
4. Photonic circuit design: electronic-photonic co-simulation
5. Photonic circuit design: layout techniques and considerations
6. Schematic-driven layout and LVS: progress and challenges
7. Uncertainty quantification and variation-aware design
8. Integrated photonics systems: modeling and simulation
9. Integrated photonics systems: optimization and reconfiguration
10. Course project presentations

Lectures might be split across multiple weeks, and/or accompanied by guest lectures/seminars.

Proposed Syllabus for *Optical Interconnects for Digital Systems*

Course Description:
High-performance systems face challenges in scaling application performance due to increased communication demands and the energy costs and bandwidth limitations of existing interconnect technologies. Recent developments in silicon photonic technologies offer solutions with high-bandwidth, low-power optical connectivity. The course will explore advanced and emerging optical and electrical interconnection networks, covering current network models and providing essential tools for designing, understanding, and evaluating system networks and architectures. It will encompass various system aspects, from photonic devices to network routing algorithms and protocols, focusing on both physical-layer and system-level energy and performance metrics.

Textbooks and References:
The course does not rely on a single textbook. Reading material will be given, drawn from research articles and book chapters, in addition to the following reference books:

1. *Optical Interconnects for Future Data Center Networks*
   Christoforos Kachris, Keren Bergman, and Ioannis Tomkos (Eds.)
2. *Principles and Practices of Interconnection Networks*
   William James Dally and Brian Patrick Towles
3. *Principles of Photonic Integrated Circuits*
   Richard Osgood jr. and Xiang Meng
4. *Computer Architecture: A Quantitative Approach – Appendix F*
   John Hennessy and David Patterson (Rev. by Timothy M. Pinkston and José Duato)

Course Components:

1. Class participation (20%)
2. Literature review presentations (2x) (20% each)
3. Course project (40%)

Lecture Schedule:

1. Course introduction and supercomputer/datacenter overview
2. Overview of photonic interconnects
3. Interconnection network design considerations
4. Network basics and flow control
5. Network topologies, routing, arbitration, and switching – part 1
6. Network topologies, routing, arbitration, and switching – part 2
7. Physical layer design: optical link and components
8. Physical layer design: optical switches
9. Photonic interconnected systems
10. Course project presentations

Lectures might be split across multiple weeks, and/or accompanied by guest lectures/seminars.