Electronic Design Automation
TUM Department of Electrical and Computer Engineering
Technical University of Munich

Seminar

Simultaneously Tolerate Thermal and Process Variations Through Indirect Feedback Tuning for Silicon Photonic Networks

Silicon photonics is the leading candidate technology for high-speed and low-energy-consumption networks. Thermal and process variations are the two main challenges of achieving high-reliability photonic networks. Thermal variation is due to the heat issues created by application, floorplan, and environment, while process variation is caused by fabrication variability in the deposition, masking, exposition, etching, and doping. Tuning techniques are then required to overcome the impact of the variations and efficiently stabilize the performance of silicon photonic networks. We extend our previous optical switch integration model, BOSIM, to support the variation and thermal analyses. Based on device properties, we propose indirect feedback tuning (IFT) to simultaneously alleviate thermal and process variations. IFT can improve the BER of silicon photonic networks to 10 -9 under different variation situations. Compared to state-of-the-art techniques, IFT can achieve an up to 1.52 ×10 8 times bit-error-rate improvement and 4.11X better heater energy efficiency. Indirect feedback does not require high-speed optical signal detection, and thus, the circuit design of IFT saves up to 61.4% of the power and 51.2% of the area compared to state-of-the-art designs.

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