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Abstract:

Design trends for next-generation Multi-Processor Systems point to the integration of a large number of processing cores, requiring high-performance interconnects. One solution being applied to improve the communication infrastructure in such systems is the usage of Networks-on-Chip as they present considerable improvement in bandwidth and scaleability. Still,as the number of integrated cores continues to increase and the system scales, the metallic interconnects in Networks-on-Chip can become a performance bottleneck. As a result, a new strategy must be adopted in order for those issues to be remedied. Optical Integrated Networks (OINs) are currently considered to be one of the most promising paradigm in this design context: they present higher bandwidth, lower power consumption and lower latency to broadcast information. Also, the latest work demonstrates the feasibility of OINs with their fabrication technologies being available and CMOS compatible. However, OINs' designers face several challenges:

— Currently, controllers represent the main communication bottleneck and are one of the factors limiting the usage of OINs. Therefore, new controlling solutions with low latency are required.

— Designers lack tools to model and validate OINs. Most research nowadays is focused on designing devices and improving basic components performance, leaving system unattended.

In this context, in order to ease the deployment of OIN-based systems, this PhD project focuses on three main contributions: (1) the development of accurate system-level modelling methods to realize a system-level simulation platform; (2) the definition and development of an efficient

control approach for OIN-based systems, and; (3) the system-level evaluation of the proposed control approach using the defined modelling methods..