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Engineering Quantum Computing: From the Algorithm to the Device

Sonia López Alarcón
Rochester Institute of Technology

Facultad de Informática
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Resumen:

Classical computing is successful and widespread today thanks to a series of abstractions that translate high-level programming languages down to electron manipulation. Similarly, for quantum computers to become viable accelerators, a comparable quantum software-hardware stack is essential to bridge high-level algorithm descriptions and physical system control. While this stack draws inspiration from classical computing, emerging quantum technologies present distinct challenges and opportunities. In this context, the Quantum Computing Research Group at the Rochester Institute of Technology focuses on optimizing the compilation pipeline for quantum accelerators. Translating high-level programs into efficient native gate sets is a computationally intensive, memory-heavy process rich with graph-based optimization problems. This talk explores the key algorithmic and memory challenges in quantum compilation, outlining emerging solutions for next-generation quantum hardware.

Sobre Sonia López Alarcón:

Sonia López Alarcón received her Ph.D. in Computer Engineering from the Complutense University of Madrid, specializing in Computer Architecture and cache design, and joined the Department of Computer Engineering at the Rochester Institute of Technology in 2009. Dr. López Alarcón brings a unique interdisciplinary perspective to the field, holding both B.S. and M.S. degrees in Physics with a strong foundation in quantum mechanics. Leveraging her background in classical computer architecture, heterogeneous systems, and high-performance computing, her research focuses on quantum computing architecture and development—specifically quantum compilation, circuit scalability, and error resilience. As the Principal Investigator leading the Quantum Computing Research Group at RIT, her work is supported by the National Science Foundation, including a prestigious award from the NSF Expanding Capacity in Quantum Information Science and Engineering (ExpandQISE) program.