Routing Algorithm for Complex Microelectronic Systems with Micro-Coaxial Interconnects

Interactive Poster Presenter: Austin Herrling[1,2]

E-Mail: aherrling@draper.com

Co-authors: Michael Ricard[1], Jason Haley[1], Juan Pablo Vielma[2], Anthony Kopa[1], David Hagerstrom[1], Caprice Gray[1]

[1]Charles Stark Draper Laboratory, Cambridge, MA

[2]Massachussetts Institute of Technology, Cambridge, MA

Abstract

The ability to rapidly package commercial-off-the-shelf (COTS) components 10-times faster than conventional integration strategies may be enabled by automated placement of micro-coaxial cables (MCCs) in place of standard wires or planar traces. MCCs eliminates the need for lengthy electro-magnetic simulations to evaluate interference and crosstalk and the COTS interconnects are fabricated all in 1 tool that closely resembles a conventional wire bonder. To achieve this rapid packaging strategy, we are forced to work with COTS that may or may not have I/O designed for wire bonding. Routing must also be done chip-to-chip rather than just chip-to-package resulting in a tangled “rat’s nest” of interconnects. Conventional wire-routing software only routes a subset of the interconnects and does not provide solutions for wire intersections. Sequencing placement is generally computationally intractable and physical ordering of interconnect placement is often operator-defined. A direct, optimal solution can be found for complex wire-only interconnects. To evaluate feasibility of building such a system, we developed an algorithm that simultaneously evaluates the build feasibility and delivers a placement procedure. Routing feasibility is defined by the ability to place all interconnects to create a working circuit and includes parameters such as wire width, component geometries, and bonder head size. We show feasibility of routing devices with 200 and 400 interconnects and discuss how the solution depends on the limits of the developing MCC dimensions and bonding strategies. We will discuss areas of future research to achieve over 1000 MCC interconnects.