

INSiAVA makes a major breakthrough

A team of researchers in the University of Pretoria's Department of Electrical, Electronic and Computer Engineering recently made significant progress in their quest to develop silicon light emitters with high optical data transfer rates that can eventually replace the copper wires currently used in the computing industry.

They have managed to design and manufacture light emitters that can attain an optical data transfer rate of 10 Mb/s – the fastest all-silicon all-CMOS (complementary metal-oxide-semiconductor) optical data links to be reported in the world to date.

This team of researchers, led by Prof Monuko du Plessis, is using silicon electroluminescent technology (generating light from an electrical current) to find a practical, usable solution to the chip-to-chip interconnect problem that faces the computer industry. They are hoping to be the first in the world to do so.

The so-called interconnect dilemma is a challenge that was predicted decades ago by Gordon Moore, co-founder of Intel. Essentially, it relates to the fact that the number of components that can be placed on an integrated circuit has doubled every two years. This trend is expected to continue.

Optical interconnects between microchips (see feature in *Innovate* 05: 2010) will potentially transfer data faster by overcoming the ever-increasing delay that results from the additional functionality incorporated onto a microchip.

The research is being done through INSiAVA (Pty) Ltd, a South African start-up company with executive offices in Pretoria and Atlanta in the USA. The company was established through start-up funding from the Carl and Emily Fuchs Institute for Microelectronics (CEFIM), based at the University.

Prof Robin Crewe, Chairperson of INSiAVA (Pty) Ltd, announced the team's breakthrough in August 2011. "Advances in device efficiency, increased output power and improved light source design have increased the measured optical output power by a factor of three

from our previous benchmark. In this latest demonstrator, the enhanced optical power increased the signal-to-noise ratio, which in turn resulted in a data transfer rate of 10 Mb/s."

He added that INSiAVA now boasts the fastest known all-silicon electroluminescent devices (switching at frequencies above 350 MHz), as well as the fastest all-silicon optical data links (data rates of 10 Mb/s) in the world. The company's aim is to attain a data transfer rate of 10 Gb/s for short-haul interchip optical communication links, all in CMOS-compatible technology. "INSiAVA has filed patents on various techniques that provide the necessary means and capability to reach this goal," he said.

Prof Du Plessis, an internationally recognised leader in the field of silicon photonics, added that the team achieved the data rate of 10 Mb/s at a statistical bit error rate of 10^{-12} , which represents a tenfold increase in data transfer over its previous achievement. "INSiAVA's light sources are completely VLSI (very large-scale integration) and CMOS-compatible with no post-processing required.

Being fully CMOS-compatible, this technology is bound to have a significant cost advantage over some of the competitive technologies being developed," he added. ➔

➔ *The research conducted at the University of Pretoria has led to the filing of patents on various techniques.*

