University chip design in Sweden, the Nordic countries, and Europe

Historical Notes by Christer Svensson

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How it all started.

Prof. Christer Svensson at Linköping University (LiU, LiTH), Linköping, Sweden, became very interested in the University chip design concept developed by prof. Carver Mead and Lynn Conway in the US. He therefore launched the first chip design course in Sweden in spring 1981; one year after the famous Mead-Conway book was printed. As we were on the threshold to CMOS at this time, he decided to develop course material for CMOS and use a CMOS process. The first course utilized a 6μm metal gate CMOS process from ASEA-HAFO, Sweden, which was directly procured by Svensson. The first multi project chip resulted from a graduate design course at Linköping University, and is shown in figure 1.
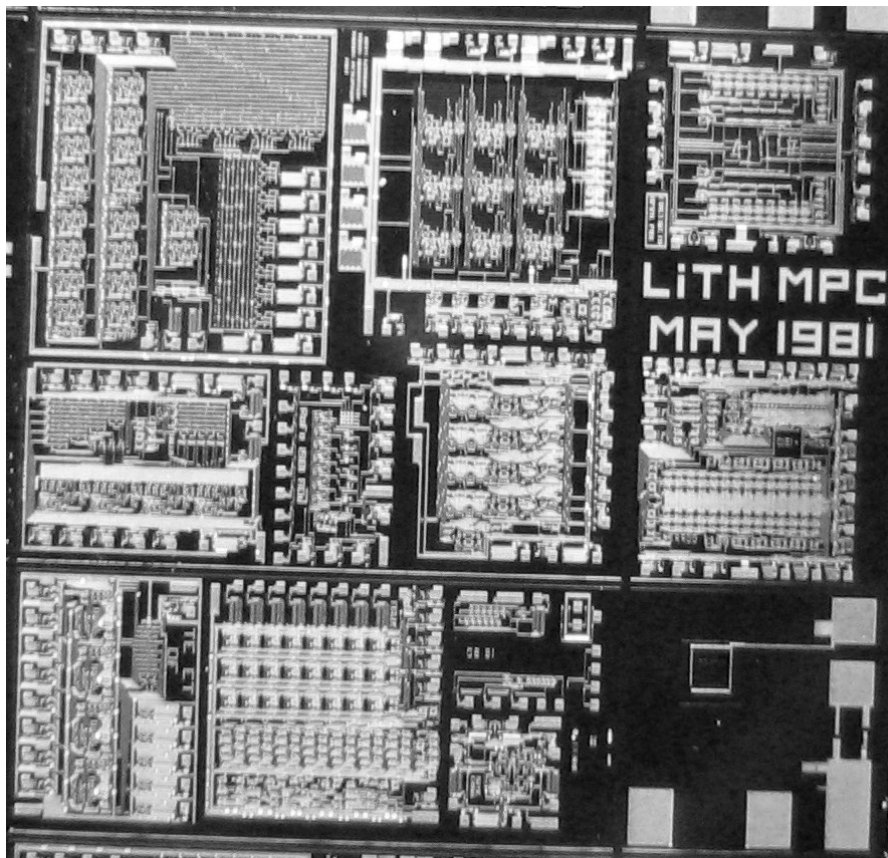

Fig. 1. The first multi project chip in Sweden.

The strange structure in the lower, right corner is a palladium gate gas sensitive transistor (the palladium was added after wafer fabrication). The chip just above that was the first version of a research chip supporting

frequency translation for hearing aids (R. Sundblad, "A method to sequentially address a large memory", Electronic Letters, vol. 19, p. 499, 1983).

Next, Svensson and his student Rolf Sundblad developed portable design rules for silicon gate CMOS and wrote a *CMOS design manual* (C. Svensson and R. Sundblad, "A CMOS design manual", Rept. LiTH-IFM-IS-72, Linköping Unversity 1983). The group also developed a simple layout tool (rather a plot program, *CIFplot*) and a switch-level simulator (R. Sundblad and C. Svensson, "Fully dynamic switch-level simulation of CMOS circuits", IEEE Trans. Computer-Aided Design, vol. 6, p. 282, 1987). Later, a more comprehensive tool set was developed by Linköping University and Chalmers University and used in both graduate and undergraduate teaching for several years.

The NORCHIP initiative.

Already in 1982, the Swedish University CMOS design concept was spread to the other Nordic countries (Denmark, Norway and Finland), to a large extent due to the work of prof. Ole Olesen, Technical University of Denmark, in cooperation with Svensson (O. Olesen and C. Svensson, "NORCHIP, a silicon brokers model", Integration, vol. 2, p. 3, March 1984). The Nordic countries developed the NORCHIP organization to run this project (with support from the Nordic Fund for Technology and Industrial Development). "NORCHIP" is still known as an annual chip design research conference with international participation. Since 1997 also the Baltic states are integrated in NORCHIP and from 2005 it was technically supported by IEEE through the Circuits and Systems Society (CASS) and consequently all papers are listed on IEEE Xplore. See www.NORCHIP.org and www.NORCHIP.org/NORCHIP_history.htm.

EUROCHIP.

Finally in 1988 there was a European initiative for University chip designs by the European Commission within Esprit Basic Research. As a result, the EUROCHIP organization was set up including NORCHIP, CMP from France, the German National Research Center for Computer Science (GMD), the Inter-University Center for Microelectronics (IMEC) in Belgium, and the Rutherford Appleton Laboratory (RAL) in the UK. Later, EUROCHIP issued a call for tenders towards vendors in 1989, and the service started in 1990. In addition to chip fabrication services, EUROCHIP offers commercial CAD tools for low cost for universities.