Design and Test in Europe

Summarizing European achievements in design and test is no easy task. The number and quality of articles submitted for publication in this special issue came from experts reporting on a broad range of industry activities and research. We were able to fit only three in our limited space, so naturally the articles selected represent but a flavor of the efforts involved in this area.

I hope in this introduction to provide more of the overall picture.

WHAT IS EUROPE?

This may sound like a silly question, but in fact even atlases disagree as to where Europe ends and Asia or the Near East begins. For our purposes, we will divide Europe into Eastern and Western regions, as shown in the box at right.
Eastern Europe

There is not a lot of interaction with Eastern European countries except at major world level events. Clearly, we must not underestimate Eastern Europe's capability in electronics; however, most researchers who make it to Western conferences exhibit a very strong bias towards the theoretical and mathematical aspects of language and formal proof. The general opinion is that this reflects an overall lack of computing and electronics hardware at these facilities.

Cooperation is paramount to Europe's success in information technology

Western Europe

As just implied, the bulk of activity in what we call the information technology industry is in Western Europe—specifically in the 12 countries of the European Economic Community, which are denoted by the * in the box below. There is also much good work outside the EEC, however. Austria is home to a number of semiconductor houses and produces research in testing. The Swiss watch industry, reeling from the impact of the Japanese digital revolution, has moved heavily into the silicon foundry and chip packaging business. The Nordic countries have a strong affinity and (together with EEC member Denmark) have created a very effective NORCHIP foundry network, similar to MOSIS. I was impressed by the automated chip layout efforts I saw during a recent trip to Norway.

Dividing Europe

Even atlases and geography books disagree on the boundaries of Europe, mainly on where Eastern Europe ends. Some books do not include any part of the USSR or Turkey; some books include the eastern parts of both; some books include the eastern part of the USSR but not any of Turkey. For our purposes, we define Europe without including the USSR or Turkey. Note that this is a geographical division, not a political one. The listings are in alphabetical order; asterisks indicate current members of the European Economic Community.

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The EEC SPIRIT

The EEC has done much in the last eight years to increase the effectiveness of Europe in microelectronics and information technology. The main funding, from Brussels, concerns cooperative projects with names like Eureka and Esprit. The next round of Esprit, called Esprit 2, will begin in 1988 and is expected to involve more than 10,000 man-years of effort in VLSI technology and CAD alone.

The primary goal of these projects is to foster cooperation. Cooperation is key to any growth Europe will experience in design and test. In most respects, the region is a loose collection of countries—all with different cultures, living standards, and, above all, languages. Thanks to the IEEE and its journals, a knowledge of English is required to be abreast of electronics. In fact, it is a de facto standard for any European meeting in this field. Luckily, most Europeans, with the exception of the lazy English, are fluent in three or four languages. Phillips, headquartered in Eindhoven, The Netherlands, insists on working in English, but it is probably the only pan-European organization that uses English all the time in all departments. At any rate, the drawback of having over 12 local languages cannot be underestimated; it is still a major task to move jobs from one country to another.

Thus, cooperation is paramount to Europe's success in information technology. It is sobering to reflect that in semiconductors the combined total European R&D expenditure far exceeds that of Japan, yet Europe is in a weak third place in terms of worldwide sales.

There is a strong interest in standards, in data exchange, for example. Despite the temptation to create something uniquely European, most organizations want to contribute to a global standard for the good of the industry as a whole.

The Esprit project has helped a great deal to break down the barriers between workers in microelectronics. There is now a healthy respect and understanding for mutual efforts, and several collaborative efforts have produced good
results. An article will appear in a future issue of D&T that describes the CVT project (by Luciano Leproni of CSELT, Italy) in which no fewer than 28 organizations across four countries were able to jointly produce an integrated set of VLSI CAD tools based on many innovative concepts.

Work is done without collaboration, of course. Most major European countries have their own national microelectronics initiatives. For example, the UK Alvey project has produced some good results in software engineering and AI research. Even so, most countries realize that to make any kind of significant impact on the market, they need to band together.

CURRENT EFFORTS

The IT industry in Europe is dominated by the “Big 12” multinationals:

- AEG-Telefunken
- Bull (France)
- CGE (France)
- GEC (UK)
- ICL (UK)
- Nixdorf (FRG)
- Olivetti (Italy)
- Philips (The Netherlands)
- Plessey (UK)
- Siemens (FRG)
- STET (Italy)
- Thomson (France)

Most of the Japanese and US computer, semiconductor, and CAD companies also have a strong presence in Europe. Several, for example, IBM, TI, ITT, and National Semiconductor, have significant European development teams.

Luxembourg, Spain, Portugal, Greece, Ireland, and Denmark are chiefly characterized by strong national microelectronics centers, several good universities, and playing host to foreign semiconductor companies.

Belgium has a strong involvement with CAD and VLSI via Leuven University and the IMEC Center. The first of our articles in this special issue is by Hugo De Man and his colleagues, who describe work with architectural front-end silicon compilers. The latest version of the system, known as Cathedral-II, reflects the local development of a European 1µ CMOS process. It represents a decade of cooperation with major companies throughout Europe in advanced chip design.

The CAD company Silvar Lisco has its origins in Leuven, but Belgium and The Netherlands are totally dominated by Philips, and the Eindhoven, Delft, and Twente Universities produce good research. The second article in this issue is by Philips workers Frans Beenker and Frank Peacock and their colleagues. This team is very much concerned with the need for a consistent test strategy across boards and chips. Frans is known throughout the world as a founder of the Joint Test Action Group. JTAG is attempting to require semiconductor suppliers to make their chip test features more visible and to move towards a unified boundary scan approach to reduce the problems of testing boards with complex VLSI chips.

Most of indigenous European industry is found in Italy, France, Germany, and England. There are also many well-known universities and research groups in these countries. However, the relationships between industry and academia vary from country to country.

INDUSTRIES

For our purposes, we will talk about the European design and test industry in terms of subindustries that contribute to some aspect of these fields.

Progress seems to be characterized by innovative approaches to problem-solving. A good example of this is described in our third article, by Joachim Mucha and his colleagues at the University of Hannover. Professor Mucha was previously at Aachen University, FRG, where he was a key member of the team that pioneered self-test and coined the term “BILBO register.” The article describes work on a set of self-testing chips to investigate various side-effects.

Test equipment

The test equipment industry is very small; only a few companies, such as Membrain and Marconi in the UK, operate in this field. Some of the big electronics companies still design and construct their own testers for use in-house.

Telecommunications and semiconductors

Philips and Siemens have combined forces in a massive investment, the Mega project, to produce mega-
bit RAMs. Key efforts also come from STC, GEC, and Plessey in the UK; Thomson; and SGS in Italy. A UK company, Inmos, has produced a most interesting VLSI component, called the transputer. Apart from pioneering some novel design methods, now seen in Racle's Isis design workstation, Inmos has developed a parallel processing language called Occam for transputer systems and for synthesis of silicon circuits.

A recent start-up called ES2 European Silicon Structures is one of the first companies with the goal of operating across Europe as a high-technology, low-volume direct-write E-beam silicon foundry.

Computers
The mainframe computer industry is represented by Bull, ICL, and Siemens. Bull is strongly linked to Honeywell technology and code. ICL designs the only mainframes with a non-US order code and markets them in approximately 60 countries. Siemens manufactures IBM compatibles.

Olivetti and Nixdorf are rapidly expanding in the office and medium size systems markets. Together with Philips, the major innovations in design automation come from these companies, with a strong push for advanced technology.

There is also a growing tendency in many divisions of all these computer manufacturers to design local versions of their products using advanced Japanese technology. A number of these Japanese collaborations have proved effective. ICL's 3900 Level 80 mainframe, for example, uses the Fujitsu cube.

CAD
The well-known logic simulator, Hilo, was developed at Brunel University in the UK. It has reached the US through GenRad. There is also a lot of interest in hardware description languages. Dacapo of Dortmund University, FRG, and Ella of RSRE in the UK are excellent examples of products that could be technically superior to VHDL but are probably destined for a small role in light of the US DoD push.

CONCLUSION
As you can see, there is no shortage of activities to report on. My only regret is that we don't have more room to print all the articles submitted. Even my introduction is sketchy, but its purpose was merely to provide a glimpse into the busy world that is design and test in Europe.

ACKNOWLEDGMENTS
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