

Art or Engineer

When hardware description languages (hdl) and synthesis brought a much needed step change in digital ic design productivity, it was easy to assume the same would happen for analogue design. Wrong! Two decades on, and with analogue extensions to Vhdl and Verilog established, there has been no corresponding dramatic increase in analogue design productivity. In the words of Jim Solomon, analogue design and simulation guru and Cadence founder: “Analogue synthesis is a complete disappointment.”

Fast Spice solvers are available for simulation, yet most analogue designers still rely on the traditional Spice algorithm. Other analogue eda tools, such as schematic driven placement, have been developed to provide a degree of automation to both schematic design and physical placement tasks. But any analogue eda vendor will confirm that adoption is poor.

Are the tools not effective or appropriate, so engineers have no choice but to design manually? Or do analogue designers relish their reputation for being creative, preferring the hand crafted approach and resisting change? The answer, is most likely, an element of both.

A recent panel discussion at DATE brought together analogue designers and tool providers, though some protagonists could claim to be from both camps. The moderator, Professor Dr Lars Hedrich of the University of Frankfurt, asked this question: “Is analogue design still more

Can automation add to creativity?

By **Louise Joselyn.**

art than engineering?” He believes it remains an art and that the vision of analogue synthesis is still far in the future.

Werner Geppert, Infineon’s director of design methodology, agreed. “It was a shame that Ahdl did not provide a comparable productivity boost. In analogue design, there are too many constraints and too many library issues. A huge effort in modelling is still needed.” Until such time, in Geppert’s view, analogue design will remain a predominantly manual task, though he would clearly like to see it shift further from art to engineering.

Jacques-Olivier Piednoir is VP for R&D at Cadence, but by training – and at heart – he is an analogue designer. “Is analogue design art or engineering? Well, engineers wear ties.” Needless to say, Piednoir was the only one on the panel line up not wearing a tie. More seriously, he qualified: “Analogue design involves a lot of manual work both for schematics and place and route. Some aspects can be automated,” he agreed, “but the analogue content of a system is typically small enough that it can be done manually, and is typically handled by one engineer.”

Dr Jurgen Scheible, head of layout design for Robert Bosch, took up the theme, reasoning that analogue design is difficult to automate. “It is complex, not



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in terms of density, but because it is not regular and there are many constraints. It simply does not lend itself to an elegant algorithmic approach, like digital design.”

Yet Dr Scheible sees great potential for analogue design tools. “Making them more intelligent is not the answer; analogue design will never be a pushbutton job. What we need is interaction between designer and tool, with the designer in the driving seat. That’s the key.”



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Responding to implicit criticism that analogue tool vendors have tried to deskill the task, Piednoir remarked: “Nobody draws every polygon; we all use tools to do that.” He said Cadence now offers ‘assisted’ layout tools, which allow the designer to program certain constraints into the software. “What looks like a manual task is often ‘assisted’. And depending on the trade offs you are prepared to make, we can automate a lot more.” In fact, Piednoir continued, tools exist for fully automated analogue design. “But you won’t like the results!” he asserted, meaning tools are still no match for humans at optimising a design.

However, for optimising a proven design or where size is less important, eda tools can generate an effective, functional design. Tools often work well for standards based designs and design reuse, using templates or known good designs, where some constraints are preset. But depending on project constraints and for many high performance or advanced designs, the panelists agreed that tools are inadequate and a manual approach is the only option.

Taking a far more pragmatic approach, TI Fellow Yves Leduc said not all analogue designers are good at what they do. “There can be hidden errors and, for that, we need automated verification tools and system level modelling. Without tools, we won’t have good quality analogue blocks.” When considering moving to 65nm, 45nm and 32nm technologies for mixed signal designs, Leduc

insists there will be no choice but to use tools. “There will be so many constraints, particularly on placement, that it only makes sense to automate.”

That analogue and mixed signal design will migrate to these smaller nodes is no longer in doubt. The drive to incorporate rf and analogue circuitry on mixed signal multifunction SoCs is unstoppable, according to other presenters at DATE.

Hans-Joachim Wassener, Director, R&D at Atmel, Germany, took a more welcoming stance. “Analogue design is certainly an art, but we use machines increasingly. We can only work eight hours a day, but a computer running statistical analysis tools can run overnight.” However, he admits that, to date, layout is still very much a manual task. “It is the only way we can optimise the design for size,” he said.

Automating analogue place and route has been the ‘bête noir’ of eda vendors. Whether circuit design and layout tasks are tackled by the same or different people, an integrated and interactive suite of tools with an effective, underlying infrastructure is necessary. Constraints might apply to groups of devices or hierarchies and routing constraints must be understood and respected, but the end result – as Piednoir and Wassener point out – must be close to that which an expert could achieve manually.

It seems analogue designers are more sceptical that design automation tools

can perform certain aspects of the job as well as they can. Or perhaps analogue designers prefer to consider themselves as more the creative artist than a tool wielding engineer? Some say analogue designers are more resistant to change. One ex analogue tool developer said he received far less cooperation and feedback from analogue designers than he now enjoys from digital engineers.

A response from the panel was to ensure the designer drives the tool, respecting the analogue designer’s view that they are artists, but also engineer. Leduc again took the balanced view, remarking that some aspects of analogue design, especially layout, are most certainly ‘art’. “But before that, it is pure science.”

Solomon recently hinted that new tool developments, emerging from analogue eda start ups, will use a new methodology, supporting constraint driven design, whereby such constraints are independent of both device sizing and process technology. He believes analogue design might finally become automated and integrated into a broader tool flow meeting open architecture standards. Solomon, an inspirational analogue designer, is rarely seen wearing a tie either. ☹