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A LOW COST DESIGN ENVIRONMENT FOR CUSTOM AND SEMI-CUSTOM INTEGRATED CIRCUIT DESIGN

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ABSTRACT

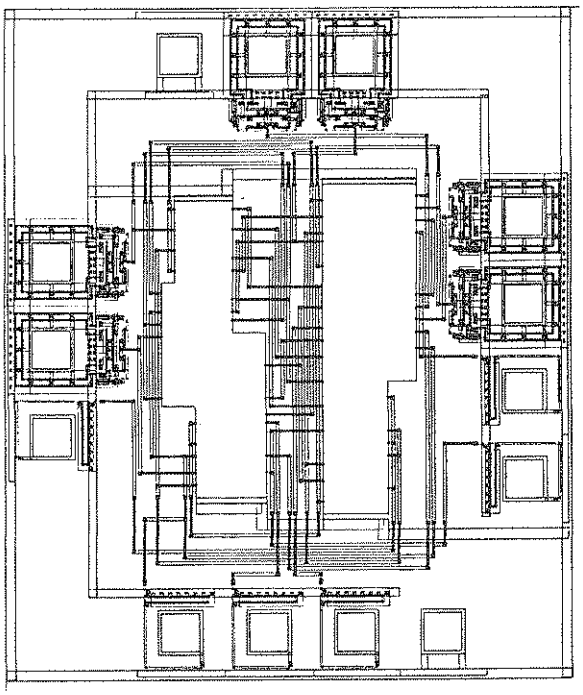
Integrated circuit design tools developed in the Department of Communication and Electronic Engineering at the Royal Melbourne Institute of Technology (RMIT) are supported by inexpensive single user workstations. Although the tools were designed for use in undergraduate teaching programmes with limited education budgets, similar budgetary constraints apply in the smaller Australian electronics based industries. Transfer of the RMIT CAD tools to Australian Industry is being funded by the Australian Federal Government.

1 INTRODUCTION

The Department of Communication and Electronic Engineering at the Royal Melbourne Institute of Technology (RMIT) has established a reputation for the innovative application of computer aided design (CAD) tools in its undergraduate teaching programs, particularly in the area of Digital Systems and Computer Engineering. CAD tools developed to support these teaching programmes have been identified by the Australian Federal Government as appropriate for transfer to Australian Industry. This transfer is being funded by the Australian Industrial Research and Development Incentives Board (AIRDIB) under of its Public Interest Programme.

A Microelectronics Technology Centre (MTC) based on initiatives originating in the Department is now well established; the RMIT section of the national Joint Microelectronics Research Centre (JMRC) within the MTC is funded by the Australian Federal Government. The MTC is recognised internationally for its research programmes particularly in areas relating to the physical and electrical behaviour of materials.

There is a close interaction between staff developing CAD tools and the MTC.



Global Chip Router Example
Figure 1

2 TOOL ENVIRONMENT

The basic CAD tools [1] for custom and semi custom integrated circuit design can be supported by Z80 8-bit microprocessor-based workstations in a CP/M environment. These very low cost workstations are used for major undergraduate teaching programs. For more advanced use the tools are supported by Motorola M68000 based workstations in a UNIX environment. The current tools have been used successfully to produce a number of custom and semi-custom gate-array designs over the past three years.

All workstations within the Department are connected to an Ethernet-based local area network allowing ready transfer of

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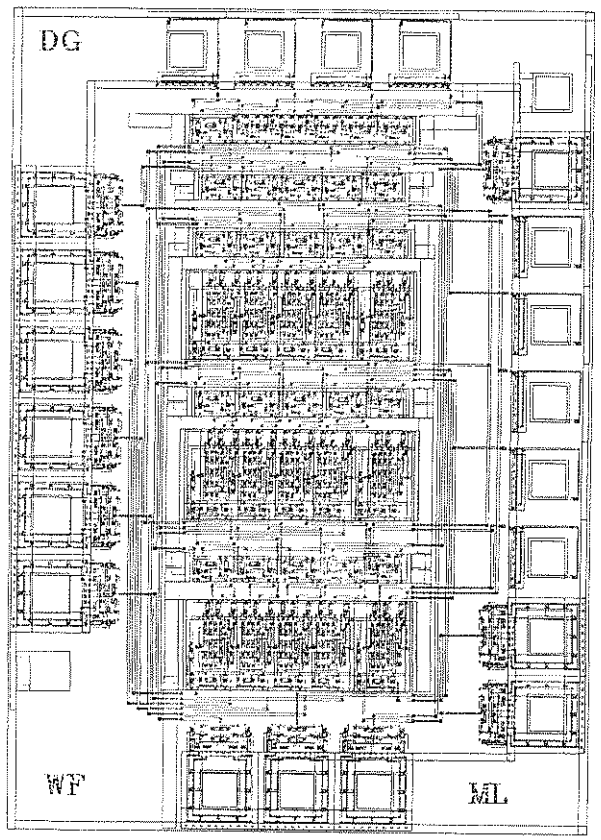
information between stations and to the lithography and fabrication facilities in the Department's MTC.

3 TOOL SET

RMIT believes that the most appropriate implementation levels for teaching and use by smaller electronics industries are standard-cell and gate-arrays [2,3,4]. The CAD tools are however capable of use in the design of full custom implementations.

The tool set has the minimum number of modules consistent with their design task. The CAD tools are comprised of several interlinked modules; a schematic entry module (Scheme); a functional level timing simulator (Simulate); for standard-cell implementations a floor plan composer (Compose) and a global chip router (Route) Figure 1; and for gate-arrays an interactive maze router (Maze).



Semester Student Project
4-Bit Cray Multiplier
Figure 2

A hierarchical graphic editor (PicEdit) is used in the development of standard-cells and gate-array macros.

A plotter module (PicPlot) allows check plots to be generated on a number of common plotter types.

Two modules (PicBeam and PicPhoto) support the E-Beam and GCA lithography facilities in the Department's Micro Electronics Technology Centre.

The output of the tool set is either a PG tape or a Caltech Intermediate Form (CIF) description. Externally sourced CIF descriptions may be incorporated readily into the cell libraries.

For portability and maintainability all modules are written in Pascal.

An example of a one semester undergraduate project, a 4-bit Cray multiplier, generated using the tools is shown in Figure 2.

3 CONCLUSIONS

The RMIT CAD tools have been used to produce a number of full-custom and semi-custom integrated circuit designs over the past three years. They are supported by inexpensive computing equipment and are be attractive for low risk entry to custom and semi-custom.

4 REFERENCES

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