

A comparative study on open source asic tools



Abstract:

Most analog and digital electronic circuit designs can be realized at different levels from the transistor to architecture level. As the complexity of Very Large Scale Integrated Circuits (VLSI) design process leads to the usage of Electronic Design Automation (EDA) tools for design and optimization.

Manual design of integrated circuits up to layout is much more complicated and time consuming process, also lack of efficiency in the fabricated chip. So that Computer Aided Design (CAD) tools are widely used in ASIC design. CAD tools provide the common path to simplify the IC design process. But the commercial tools are very much expensive and not able to use as an individual. For that purpose open source EDA tools are used for study of an IC design. In this research, it mainly concentrates on available open source and freeware EDA tools with its usage on IC design and development process are presented and evaluated. This research also gives a fundamental idea on how the open source EDA tools have helped the researchers and students to learn and fabricate their own Integrated circuits.

Introduction:

Electronics systems are take part a crucial role in every human life.

Electronic systems ranging from Integrated Circuits (ICs) to PCB (Printed Circuit Boards) are developed and produced by CAD tools. CAD tools are the collection of rules, algorithms, different methodologies and tools which automate the design, testing and verification of electronic devices. There are many commercial CAD tools are available, which are the industry standard and they are very expensive to bought such licenses. For academic and

small scale industries usage of those tools are limited due to the cost. So the alternatives are Free and Open-Source Software EDA tools are the only effective way for students and teachers to learn and implement their ideas by modifying the source code.

There are lot of open source and freeware tools are available for analog and digital circuit design. But the problems behind those softwares are integration of multiple tools for a complete design; installation procedure, operating systems, etc. are the various factors. From the above said considerations the tools such as Qflow and Magic from open circuit design tools, Electric from static free software, alliance, LASI, topped, microwind are considered for this research.

Open Circuit Design Tools:

Alliance:

Alliance is a VLSI tool having numerous of tools integrated together with portable libraries. It contains VHDL compiler and simulator, synthesis, auto place and route tools. For digital design a complete set of portable CMOS libraries are provided [1]. Alliance is developed and maintained by ASIM department of LIP6 laboratory at Pierre & Marie Curie University, France.

Alliance is free and open source software initially developed for teaching VLSI design. Its binaries, source code and cells libraries are distributed under the GNU General Public License. Alliance tool has been used in many research projects. One is Superscalar 128-bit Very Long Instruction Word

(VLIW) microprocessor [2] was designed by alliance CAD system and IEEE Gigabit HSL Router.

The main features of Alliance includes, it supports the standard VLSI description formats like SPICE, EDIF, VHDL, CIF and GDSII. It has built in design and simulation tools. It is easy to learn and use, also convenient to get the resources online. It includes logical synthesis tool which supports VHDL synthesis. The Alliance design flow includes design, synthesis and simulation along with optimization by using different kind of tools. The Alliance tools are independent, interact with each other and has more than 150 documented standard cells and six custom optimized generators [3], also it does not require a high performance workstation like Cadence; however, it is designed for UNIX based platform.

Electric:

Electric VLSI Design System is a high performance open source EDA tool that provides complete aids in designing the IC layout. It is a sophisticated system which can handle a range of fabrication CMOS technologies. It has many generic analysis and synthesis tools which automates the design process. It integrates the schematic editor, circuit simulator, schematic driven layout generator, layout editor, layout verification and parasitic extraction. The major advantage to Electric VLSI Design System is that, it allows swapping between the designs data with other standard EDA tools in the industry. It supports most popular formats such as EDIF, VHDL, GDS, LEF/DEF, etc.

Initially, the Electric VLSI design system was written in C language in 1982 by Steven Rubin [4] at the Fairchild A. I. Laboratory in Palo Alto, California. Later it was ported to Java acquired by Oracle. Irrespective of all other CAD tools Electric had a combination of graphics, connectivity, and accurate geometry for IC design.

The Electric design system has a huge database which is built on network structure, primarily to implement connectivity. The network has nodes and arcs [6], which are components in the circuit and connecting wires respectively. These network nodes and arcs have their own geometric data, for a correct representation of the circuit. Electric has an expansive database and can store a large number of structures, design rules are incorporated.

The Electric VLSI system provides many features such as:

1. Integrity - Schematic, Layout and the supporting packages are integrated in one file.
2. No node extraction - Electric provides geometry connectivity information. So there is no need to extract nodes separately
3. Geometry errors
4. simpler design process
5. powerful editing with LVS check