Abstract of the book "*PLD architectures and PLD based digital system design method"*

Authors names: Enrique Mandado, Jacobo Alvarez, María Dolores Valdés

Address: Instituto de Electrónica Aplicada Pedro Barrié de la Maza
Universidad de Vigo. Apartado Oficial de Correos, Vigo, Spain
Phone: 34986812223; Fax: 34986469784

ABSTRACT

PLD became standard integrated circuits and are very useful for digital systems implementation. But PLD constitute by themselves complex digital systems characterised by a set of basic non-excluding concepts that are themselves divided into a great number of subconcepts. Due to this, learning PLD architectures and PLD-based digital system design are difficult tasks. This situation justifies the development of a special learning method, including the following phases:

- Definition of configurable digital circuits.
- Differences between Programmable and Configurable Digital Circuits.
- Analysis of the main concepts associated with PLD circuits classifying them into Basic (BPLD), Advanced (APLD) and Complex (CPLD).
- Description of commercial PLD from Lattice, Altera and Xilinx using the previous concepts.
- Learning of complex digital systems design phases: Description, Compilation & Implementation and Verification.
- Application of the aforementioned phases to the design of PLD based digital systems.
- Design of real digital systems using commercial PLDs from different manufacturers.

The book is divided into three parts as briefly described next.

1 PLD Architecture Analysis

The most important PLD concepts are defined: Macrocell, Programmable Interconnect Matrix, Product or Sum of products sharing circuits, number of Programmable Interconnect Matrixes, Distributed Interconnect Resources and Complex (Configurable) Logic Blocks.

Through a set of forty-three figures all these concepts are analysed, first separately, and then combined. The analysis starts with the simplest PLD circuits (Basic PLD), that have just one Programmable Interconnect Matrix (Figure 1). Once the most important types of BPLD being analysed, the different ways to share logic products or sums of logic products are studied. Sharing circuits are one of the elements of Advanced PLD (APLD). Then, segmented Advanced PLD, with multiple Programmable Interconnect Matrices, are analysed (Figure 2). Finally, the different ways to increase the complexity of Advanced PLD are studied. These new concepts are present in Complex PLD (CPLD).

2 PLD-Based Digital Systems Design Process

From their experience in PLD-based digital system design the authors developed the design process explained in the tutorial. Each stage of the design process is analysed with the help of an adequate example.

Special emphasis is made in the description phase through the use of Hardware Description Languages (HDL), as well as in the verification stages through the whole design process including static timing analysis and timing simulation. PLD configuration through Boundary Scan standard is also described.

3 PLD-Based Real Digital Systems Design

To consolidate the learning process of the previous concepts several real digital systems are chosen and their complete design is developed. Previously, the PLD selection criteria are analysed to choose the right PLD for a specific digital system design. A set of general rules developed by the authors is also described to obtain an optimal implementation of the digital system.