CONCLUSION

In this dissertation we developed the methods and algorithms of Logic Differential (LD) Calculus related to the problems of Computed-Aided Design of Multiple-Valued devices. Author's objective is to *bring methods of LD Calculus closer to engineering practice*.

New results in the applied theory of LD Calculus. Modern LD Calculus has been developed based on the generalization of Boolean Differential Calculus for MVL functions. The traditional methods and algorithms of computations of LD Calculus operators are represented by symbolic mathematical tools. The basis of our study was the matrix approach. We developed early results by applying methods of matrix algebra.

We presented LD Calculus in matrix notation for the first time.

Our approach based on matrix tools

- studied the results obtained in the area from the unified position,
- overcame the theoretical difficulties and developed the theory of LD Calculus.

It allows us to conclude that the main result of this dissertation consists in the *development, systematization and generalization* of the applied LD Calculus theory.

The most important theoretical results are:

- Synthesis of a class of matrix algorithms to calculate Boolean Differential operators,
- New LD operators for MVL functions introduced with respect to the criteria of reconciliation with fixed polarity RM expansions, or logic Taylor series,
- Matrix methods to solve logic equations and logic Differential equations in RM forms, and
- New LD operators introduced for arithmetical polynomial domain.

New results in the MVL Design. A particular significance for engineering practice presented in the dissertation is the generalized *D*-algorithm for MVL combinational circuits, where the generation of the *D*-cubes is maintained by LD operators.

Besides, there has been developed in the dissertation

- A technique to compute LD operators, including systolic arrays and homogeneous structures,
- A generalized method and algorithms to minimize incompletely specified MVL functions in RM and Arithmetical Polynomial domain;
- A generalized *D*-algorithm for test detection in MVL combinational circuits,

- An algorithm for sensitivity analysis of MVL network, and
- A method of circuit analysis (fault analysis, decomposition).

In general, the mentioned theoretical and applied results are important steps to incorporating LD Calculus methods into the frameworks of practical application.

Future work. The MVL design methods are connected closely with the technology to manufacture the MVL devices. This is a dynamic and flexible area both on the implementation and theoretical levels. So, the methods and algorithms that have been developed in the dissertation must be attuned to present day technology achievements and requirements. The presented matrix tools to calculate LD Operators is a good base to synthesize parallel algorithms on the homogeneous architectures of different types (systolic arrays, FPGA and other parallel structures).

The techniques such as BDD which are intensively developed in Logic Design and are applied for RM domain synthesis, also have all premises to be used in the area. This problem was considered in part here to calculate LD operators for MVL functions. Further steps are required to develop the BDD techniques to solve the applied problems solved by LD Calculus methods.

The forming of the theory of LD Calculus is not complete without investigations and generalizations in the arithmetical polynomial domain. These operators require further development to be harmoniously integrated into the area.

The circle of the applied problems solved by LD Calculus methods have to be extended taking into account recent achievements of the MVL Design. The present dissertation does not concern the graph analysis problem, design of sequential circuits, applications in the automata theory and others. Being developed from the Boolean Differential Calculus, LD Calculus theory has not found such wide application as the Boolean one. It can be said that the main operators of LD Calculus and its application to solve several important problems of MVL design are the basis to investigate and develop this direction.

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