C H A P T E R 8

CONCLUSIONS AND FUTURE WORK

8.1 Conclusions

The integration of the RASSP test bench generator and the goal tree system described in this dissertation provides a high level test planning system for validation of DSP circuits modeled in VHDL. The goal trees used in the test planning framework provide a powerful graphical means for capturing and visualizing a test plan. Sampling strategies used in the confirmation goals build the tester's level of confidence. Search strategies explore the boundary value conditions in the output space and produce effective

test vectors. A significant enhancement in stimulus generator simulation efficiency has been made on the RASSP test bench generator. Support of the file I/O feature enables the test plans and test vectors created for testing in the development phase to be reused in the diagnosis and maintenance phases.

The integrated test planning system including friendly graphical user interfaces has been implemented on a Solaris platform. It has been applied to automate the testing activities of a SAR model. The simulation efficiency is so improved that a test case can be generated in 2 minutes. The completeness and effectiveness analyses show that the generated test set achieves 100% statement coverage, 100% branch coverage, and 94.0% mutation score. All these show that the test planning system is efficient, effective, and easy to use.

8.2 Future Work

This project has a wide range of future research possibilities.

1. Testing at Mixed Level of Abstraction. Currently, selecting the comparator parameters and assigning the generic values to the test bench are supported by goal trees. Selecting library models of both MUT and the stimulus generator and assigning parameter values to the MUT are supported by the test bench generator. A possible improvement is to incorporate the goal trees with the capability of assigning generic values and selecting

library models for components for the MUT, stimulus generator, and comparator. This would allow the user to create test plans for models at different levels of abstraction.

2. More Test Strategies. Currently, the test planning system supports sampling strategies, search strategies, and file I/O strategy. Also, a test strategy allows a single primary requirement to vary. More complicated test strategies can be defined to support more types of primitive goals.

3. Expansion of Operator Nodes. Currently, the set of operator nodes contains the *AND* nodes and the *OR* nodes. Another future work is to expand the operator nodes for more flexible control over the sequence of tests in a test plan. For example, Figure 8.1 shows an *IF-THEN-ELSE* node which chooses between the goals G_1 and G_2 based on a given predicate, and Figure 8.2 shows an *UNTIL* node that allows the execution of the test groups TG_1, TG_2, …, until a given condition is met.

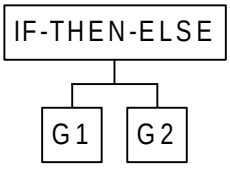

Figure 8.1 An IF-THEN-ELSE Operator

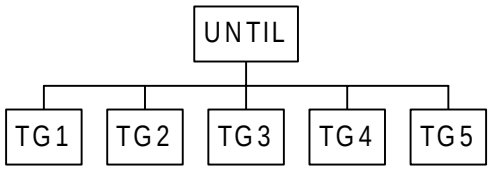

Figure 8.2 An UNTIL Operator

4. More Aspects and Types of Devices. The current test planning system validates the functionality of VHDL DSP models, in which the arithmetic operations in the data path are focused at a high level. Possible future efforts could be to extend the test planning system toward structural testing, or testing other aspects of models such as arithmetic operations at a lower level, timing verification in the control path, and memory element testing. More test strategies are needed for different aspects of models and different types of devices. Chapter 7, which extends the functional goal tree concept toward the structural aspect of hierarchical system models for testing and diagnosis could be a first step. It would be desirable to implement a board level testing planning system and interface it with a diagnosis engine that can automatically compare wave forms of probes at the logic level.

5. More Application Areas. Another future research area could be the application of the test planning system to design tradeoff analysis and regression testing. Also, the application to test tradeoff analysis could be a future area. For example, based on the resource constraints such as the total number of test cases, how we determine the lengths

of the confirmation test groups to achieve the maximal level of confidence could be an important issue in test economics.