

The VHDL Validation Suite*

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Abstract

A validation suite for IEEE standard VHDL is discussed along with its executive manager. Test points are generated from the VHDL LRM (Language Reference Manual) syntax diagrams and sentences. Each test in the suite contains a test header which is specially formatted and keeps information such as test point, test objective, test result, and test type. The suite executive manager is menu-driven and efficiently classifies the tests based on different criterion defined in the test header. Coverage is defined to measure how closely a VHDL tool covers the LRM and is also computed by the suite executive manager.

Introduction

With the designation of a standard version of VHDL by the IEEE, tool makers [1-4] are developing software which processes VHDL descriptions for various applications, e.g. simulation, synthesis, and test generation. As with all software programs, these tools must undergo extensive testing to prove their reliability. A major concern in this testing process is that the tools will correctly interpret VHDL source as defined in the language reference manual (LRM) for IEEE 1076 [5]. While individual vendors can, (and do) develop their own tests, their test selection could be biased by their local experience in tool development. A more effective approach is to have an independent agent or agency develop a validation test suite, an approach that was used to further the development of other languages [6-9].

In this paper we describe a co-operative effort sponsored by a group of VHDL tool developers. The sponsoring companies are CAD Language Systems Inc., Daxix, GenRad, MCC, Silicon Compiler Systems, Vantage Analysis, and ZYCAD. The development of the suite is being carried out at the Department of Electrical Engineering at Virginia Tech. The goals of the project are to develop a comprehensive validation suite for VHDL and VHDL subsets. The staff at Virginia Tech archives test cases

provided to it by participating member companies. It analyzes these test cases to assess their coverage of related language reference manual sections. The test cases from the participating companies are combined into one validation test suite which gives good coverage of the LRM and eliminates redundancy between individual tests. To achieve this goal, the staff at Virginia Tech develops necessary test cases to augment those submitted by the participating companies. It is expected that when the suite is complete it will be turned over to the National Institute of Standards Technology (formerly the National Bureau of Standards) who, it is hoped, will oversee the validation of the specific vendor tools against the suite. In anticipation of this, Virginia Tech has co-ordinated the development of the suite test philosophy and format with NIST.

The main purpose of this paper is to describe the technical aspects of the suite and the implications it has for the development of proper tests for VHDL tools.

Test Development Methodology

In this section we describe the methodology to be used in developing tests for the VHDL Validation Suite. We begin with a discussion of basic test philosophy and then define basic terminology and format of the tests that make up the suite.

Test Philosophy

Tests can be either large or small. Large tests cover a relatively large number of language features. In contrast, small tests cover a single or small number of language feature(s). While large tests can lead to a shorter overall suite length, short tests are preferred because of their superior fault isolation capability. The VHDL Validation Suite is made up primarily of small tests.

Tests are either expect success or expect failure tests. Expect success tests consist of correct VHDL code. A tool analyzing these tests should produce no error indication. Expect failure tests consist of incorrect VHDL code which the tool should flag as being in error.

The suite consists of a (large) set of tests. Interdependence between tests and dependence of tests on design library entries and external files should be minimized. Thus, while the use of packages [5] is important in the normal use of VHDL [10-12], the use of packages in the

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