



OpenCores.Org

# Random Number Generator Library

## User Guide

*Author: Geir Drange*  
*gedra@opencores.org*

**Rev. 1.0**  
**September 28, 2004**

*This page has been intentionally left blank.*

## Revision History

Rev.	Date	Author	Description
1.0	02/09/04	Geir Drange	First version

# Contents

<b>1 INTRODUCTION.....</b>	<b>1</b>
<b>2 USING THE LIBRARY .....</b>	<b>2</b>
2.1 SEEDS .....	2
<b>3 EXAMPLE TEST .....</b>	<b>3</b>
<b>4 KNOWN ISSUES.....</b>	<b>6</b>

# 1

---

# Introduction

When writing test benches, it is often useful to include a degree of randomness in the simulation. Typical examples are:

- Random data generation
- Adding noise to signals
- Generate random delays
- Clock jitter generation
- Etc

VHDL does not have any built-in functions for random numbers (yet). The Random Number Generator Library can easily be included in a test bench to supply random number functions.

Note that this library will NOT synthesize. It is intended for test bench use only.

# 2

# Using the library

To use the library, add the following line to the test bench:

```
use work.rng_lib.all;
```

A random variable is defined by a record, and must be initialized before use. There is a separate initialization function for each type of distribution. Example:

```
r_uni := init_uniform(0, 0, 0, 0.0, 200.0);
```

will initialize a uniform distributed variable with values between 0 and 200. The random variable (real) is accessed by the .rnd member of the record:

```
r := r_uni.rnd; -- r is a real  
i := integer(r_uni.rnd); -- i is an integer
```

Generate a new number with the rand() function:

```
r_uni := rand(r_uni);
```

## 2.1 Seeds

The first 3 parameters (a, b, c) for the initialization functions are seeds for the Tausworthe generators. If a seed is set to zero, a predefined seed will be used. Predefined seeds will also be used if a < 3, b < 9 or c < 17.

3

# Example test

The file tb\_rng.vhd will generate 10000 numbers of each of the distributions, and make simple plots in the log window:

Uniform distribution:

The image shows a decorative border composed of blue asterisks. It features four horizontal lines of asterisks, with each line containing exactly 28 asterisks. The lines are evenly spaced, forming a perfect rectangle. The asterisks are a vibrant blue color.

Gaussian distribution:

## Exponential distribution:



# 4

---

## Know issues

The library will not work with Symphony EDA Sonata simulator. Due to bad floating point support?