# TYPE 578: RANDOM NUMBER GENERATOR DRAWN FROM NORMAL DISTRIBUTION

## General Description

This model generates a random number drawn from a normal distribution based on user-supplied values of an initial seed, mean and standard deviation.

## Detailed Description

As with Type 577, at the heart of the Type578 random number generation routine is the Fortran intrinsic function called RAN. RAN returns the next number from a sequence of pseudorandom numbers of uniform distribution over the range 0 to 1. As an argument, it takes an integer seed that should ideally be a large, odd number. As a result, it returns the double precision representation of a real floating point number that is uniformly distributed between 0.0 (inclusive) and 1.0 (exclusive). For more information on the RAN function, refer to the Digital (Compaq, or Intel) Visual Fortran documentation.

Type578 performs the following steps in order to convert the Fortran generated uniformly distributed number into a normally distributed random number. It repeatedly obtains two uniformly distributed random numbers (X, and Y) until the algorithm shown in equation 578.1 results in a number less than 1.0

$$RSQ = X^2 + Y^2 \qquad \text{(Eq. 578.1)}$$

The values of X and Y are obtained from the algorithms shown in equation 578.2.

$$\begin{aligned} X &= 2 * RAN(SEED) - 1.0 \\ Y &= 2 * RAN(SEED) - 1.0 \end{aligned} \qquad \text{(Eq. 578.2)}$$

Once satisfactory values of X and Y have been obtained, the normally distributed random number is generated from the algorithm in equation 578.3.

$$Z_{rand} = StdDev * X * \sqrt{\frac{-2.0 * \log(RSQ)}{RSQ}} + mean \qquad \text{(Eq. 578.3)}$$

in which *StdDev* is the standard deviation and *mean* is the mean value specified as inputs to the Type by the user.

## Example

Type578 is used in the following Simulation Studio example:
\trnsys16\TESS Models\Studio Projects\Utility Library\RandomNumbers.tpf

## References

Digital Fortran Language Reference Manual, Digital Equipment Corporation, Maynard, MA 1997