

Operator GENE_VARI_ALEA

1 Drank

To generate a realization of a real random variable of model of probability given (models gamma or exponential exits of the application of the maximum of entropy, [R4.03.05]).

In output, a reality is obtained.

2 Syntax

```
[reality]      =GENE_VARI_ALEA      (  
  
    ◇ /TYPE      = ' GAMMA '                [DEFAULT]  
      ◇VALE_MOY=/valeur_moy                [R]  
                                          /1.0          [DEFAULT]  
      ◇BORNE_INF=/a                          [R]  
                                          /0 .          [DEFAULT]  
      ◇ COEF_VAR=/delta                      [R]  
                                          /0.1          [DEFAULT]  
  
    /TYPE      = ' EXPONENTIELLE '          [R]  
      ◇VALE_MOY=/valeur_moy                [DEFAULT]  
                                          /0 .          [R]  
      ◇BORNE_INF=/a                          [R]  
                                          /-1.0         [DEFAULT]  
  
    /TYPE      = ' EXP_TRONQUEE '           [R]  
      ◇VALE_MOY=/valeur_moy                [DEFAULT]  
                                          /0 .          [R]  
      ◇BORNE_INF=/a                          [R]  
                                          /-1.0         [DEFAULT]  
      ◇BORNE_SUP=/b                          [R]  
                                          /1.0          [DEFAULT]  
    ◇INIT_ALEA=ni                          [I]  
  );
```

3 Operands

3.1 key Key TYPE

According to information usable on the random variable to simulate, three types of model of probability are available. If information available is a support not limited $[a, +\infty[$, an average \underline{w} , and a scatter coefficient δ , the model is gamma. If information available is a support not limited $[a, +\infty[$ and an average \underline{w} , the model is exponential. If information available is a compact support $[a, b]$ and an average \underline{w} , the model is exponential truncated.

/TYPE = " GAMMA" [DEFAULT]

the random variable follows a model of probability of type "gamma" of which the probability distribution $P_w(dw)$ is defined by :

$$P_w(dw) = I_{[a, +\infty[}(w) \frac{(\underline{w}\delta^2 - a\delta^2)^{-\frac{1}{\delta^2}}}{\Gamma\left(\frac{1}{\delta^2}\right)} (w-a)^{\frac{1-\delta^2}{\delta^2}} \exp\left\{-\frac{w-a}{(\underline{w}-a)\delta^2}\right\} dw$$

$$\text{with } \Gamma(z) = \int_0^{+\infty} t^{z-1} e^{-t} dt$$

/TYPE = "EXPONENTIELLE"

the random variable follows a model of "exponential" probability of the type of which the probability distribution $P_w(dw)$ is defined by :

$$P_w(dw) = I_{[a, +\infty[}(w) \frac{1}{\underline{w}-a} \exp\left\{-\frac{w-a}{\underline{w}-a}\right\} dw$$

$$\text{with } I_{[a, +\infty[}(w) = 1 \text{ si } w \in [a, +\infty[\text{ et } I_{[a, +\infty[}(w) = 0 \text{ si } w \notin [a, +\infty[$$

/TYPE = "EXP_TRONQUEE"

the random variable follows a model of exponential probability of the type "truncated" of which the probability distribution $P_w(dw)$ is defined by:

$$P_w(dw) = I_{[a, b]}(w) \frac{k}{\alpha(k)} e^{-kw} dw$$

$$\text{with } I_{[a, b]}(w) = 1 \text{ si } w \in [a, b] \text{ et } I_{[a, b]}(w) = 0 \text{ si } w \notin [a, b] \text{ and where } k \text{ is such that } (\underline{w}k - 1)\alpha(k) - k\beta(k) = 0, \text{ with } \alpha(k) = e^{-ak} - e^{-bk} \text{ and } \beta(k) = ae^{-ak} - be^{-bk}.$$

3.2 Key word VALE_MOY

◇VALE_MOY=/ \underline{w} [R]
/0 . or 1.0 [DEFAULT]

Indicates the mean value of the random variable to simulate.

3.3 Key word COEF_VAR

◇COEF_VAR=/ δ [R]
/0.1 [DEFAULT]

This key word informs the scatter coefficient (standard deviation ratio on absolute value of the average). The value taken by default is 0.1.

3.4 Key words BORNE_INF AND BORNE_SUP

◇BORNE_INF=/ a [R]
/-1.0 or 0. [DEFAULT]
◇BORNE_SUP=/ b [R]
/+1.0 [DEFAULT]

These key words inform the lower limit and the higher limit (when they exist) support $[a, b]$ or $[a, +\infty[$ models.

3.5 Operand INIT_ALEA

◇INIT_ALEA=/ni [I]

Causes the initialization in its `nor-ième` term of the continuation of pseudo-random numbers used for the generation of the variables.

If key word `INIT_ALEA` is absent, the terms used of the continuation are those immediately consecutive with those already used. If no term were still used, the continuation is initialized in its first term.

Suggestion:

A less than one particular use, it is advised not to inform key word `INIT_ALEA` in the operators according to: `GENE_FONC_ALEA`, `GENE_VARI_ALEA` and `GENE_MATR_ALEA`. In this case, with the first call to the one of these operators, the continuation of pseudo-random numbers is initialized in its first term. The omission of key word `INIT_ALEA` to each call of these operators in the command file guarantees the statistical independence of the pseudo-random numbers used.

Note:

The germ of the continuation remains identical of one execution to the other of Code_Aster; the results thus remain rigorously identical (one can thus test non regression of the results statistical ones not converged). If one wishes to generate results statistically independent from one execution to another, then it is necessary to use key word `INIT_ALEA` with values raising the number of terms used in the former executions.

Caution:

The generator of random variable used is that of the modulus "random" of Python. It depends on the version of Python exploited by Code_Aster. Not statistically converged results can thus vary from one version to another of Code_Aster or platform to another, if the version of Python is not the same one and that between the two versions the modulus random evolved (case between Python 2.1 and 2.3).

Note:

*In version Python 2.3, the period of the generator is of $2^{**} 19937-1$.*

4 Example

By call, the command generates only one realization of the random variable to simulate. To generate several achievements of the same random variable, it is necessary to repeat the command without changing its parameters or placing the command in a loop of the language of command of Code_Aster - the language Python. Each realization is statistically independent of the other achievements.

In the following example, one generates ns achievements of a random variable gamma of mean value 25000, of support and scatter coefficient 0.1 positive realities. These achievements are then used as values of stiffness of shock.

```
ns=100

for K in arranges (1, ns+1):

# Generation
  KN=GENE_VARI_ALEA (
    TYPE=' GAMMA',
    BORNE_INF=0      .,
    VALE_MOY=25000   .,
    COEF_VAR=0.1     ,
  )

  DYN=DYNA_TRAN_MODAL (
    ...
    CHOC=_F (
      ...
      RIGI_NOR=KN    ,
      ...
    )
  )

# Here for example, statistical processing DYN

  TO DESTROY (CONCEPT=_F (NOM= (DYN, kN)))

# End of the loop (indentation)
```

For more complete examples, one can consult documentation "Computational simulation of Monte Carlo" [U2.08.05] or the case test SDNS01 [V5.06.001].