

# Readme.pdf for RUPGEN

Prepared by Ling Zhang, 2012

## Introduction

A brief description is given here for the main parameters used in the RupGen C++ program codes. The codes implements several publications namely correlated random slip field of Mai and Beroza (2002), scaling functions of Mai and Beroza (2000), and Wells and Coppersmith (1994), amongst others. The detailed descriptions of the parameters are given in the files: *SlipReal.cpp*, while those used for COMPSYN simulations are given in the file *SXSLIPinput2C.cpp*.

Ling Zhang wrote the C++ programs, which originally was coded in MATLAB by Martin Mai. Likewise, Hugo J. Cruz converted the same into Python codes.

## Input files

The codes include two input files: input.dat and vmodel.dat.

### 1. Input.dat

The below parameters are read in *Mainpro.cpp*.

- srcp\_size: the size of vector srcp, its value may be 0, 2, 3, 4
- srcp: the vector of source parameters, if srcp\_size=4, srcp=[W L Mw D]  
 srcp[0] //W=Fault width(km)  
 srcp[1] //L=Fault length(km)  
 srcp[2] //Mw=Moment Magnitude  
 srcp[3] //D=Mean slip(m)
- mech: focal mechanism "ss", "ds" or "al" for strike-slip, dip-slip or both types
- corr\_size: the size of vector corr, its value may be 0, 1, 2, 3
- corr: the vector of correlation length and/or spectral decay parameters, if corr\_size=3,  
 srcp=[az ax H]  
 corr[0] //az  
 corr[1] //ax  
 corr[2] //H= Hurst number

- model: your\_model\_name, string to label your model
- snum: seed option for the random-number generator, if snum=0 use new seeds or snum=1 use previous seed values by reading the file seed.txt

The below parameters are read in *CreateRupt.cpp*.

- ferq[3]: the array of frequency (as used in COMPSYN).
- htop: depth at the top of the fault plane
- STF: source time function (Box, Exp, Kos, Trian, Ramp, InvSQRT, Yof)
- samp[2]: sampling of dislocation model in z, x direction [dz dx]
- grd: slip function option. "nod" for grid-nodes and "sub" for sub-fault definition
- nex: non-linear scaling exponent for the random field (i.e  $S = S^{\text{nex}}$ )
- taper: tapering the edges of the slip model, its value may be "y", "d" or "x"
- ta\_size: the size of vector tapkm, its value may be 0, 3, 4, 5
- tapkm: the vector of tapering, if ta\_size=5, tapkm=[left/right top bottom P ratio]  
 tapkm [0] //left/right  
 tapkm [1] //top  
 tapkm [2] //bottom  
 tapkm [3] //P is an additional depth-dependent tapering of the form  $z^P$   
 tapkm [4] //ratio
- wl\_size: the size of vector wlevel, its value may be 0, 1
- wlevel: the vector of method option to scale the zero-mean random field to nonnegative slip, if wl\_size=1, wlevel[0] may be 0, -1, -2, -3, -4
- depth: max. depth of rupture plane
- acf: autocorrelation function option, its value may be "ak", "ex", "fr" or "gs"
- zmin:
- AMw: the given area, if srcp\_size=0, uses this value to compute W, L, Mw and D
- rel: scaling laws option, its value may be "MB", "WC" or "WG"
- fig: option to view the slip realization, its value may be "y" or "n"
- outfile: string for a filename to write the slip realization, its default value is "n"
- hypo[2]: the array of coordinates of hypocenter

- `slpdir`: slip direction, its value may be " LL ", " RL ", " NO " or " TF "
- `vrat`: ratio of shear-wave to rupture velocity, its value is generally between 0.6 and 0.95
- `vrnd`: randomize the resulting rupture times, its value may be 0 or range 0.1-0.4
- `dur`: rise time(s)

The below parameters are read in *SXSLIPinput2C.cpp*. These default settings are used in SLIPDT-code (used in COMPSYN).

- `decay=0.8`: power decay
- `xobs=0.0`: observer locations, give [0 0] for all
- `yobs=0.0`
- `rn timer=10`: the number of points in quadrature
- `numin=30`: min. number of points in x, y
- `nvmin=30`
- `durfc=1.0`: duration factor for rise time
- `vrat=1.0`: standard for NO change in vr, vrat

## 2. **vmodel.dat**

The below parameters are read in *CreateRupt.cpp*.

`v_size1` and `v_size2`: the size of two dimensional vector `vprof`.

`vprof`: the two dimensional vector of velocity model.

## Output files

The outputs generated by the codes are saved in the following files, where “model” and “outfile” are the file name parameters you choose.

### 1. **model.SLD**

This file is generated from *SXSLIPinput2C.cpp* to save some data.

### 2. **run.SS.model**

This file is generated from *SXSLIPinput2C.cpp* to get executable shell-script to run DOT9.

### **3. model.mat**

This file is generated from *CreateRupt.cpp* to save all parameters for later use.

### **4. seed.txt**

This file is generated from *CreateRupt.cpp* to save all seed values for the random-number generator. If the parameter *snum*=1 use previous seed values by reading this file.

### **5. outfile**

This file is generated from *WriteArray.cpp* to save some data.

### **6. Data\_to\_fig**

This folder includes some files generated from *SpecSyn2.cpp*, *SlipReal.cpp*, *RupTime.cpp* and *CreateRupt.cpp*. These files save some data in order to plot figures using MATLAB.

## **Running the program**

You need a C++ compiler and the software MATLAB, and then you can run this program and plot figure.

1. Run 'make' to compile the program.
2. If everything goes well, then run './rslip' to execute the program.
3. Call the function *plot\_fig.m* in *Data\_to\_fig* using MATLAB to get figure.