

# README

Lingqing Yao  
yaolingqing@gmail.com

Wednesday 5<sup>th</sup> February, 2020

## 1 Introduction

The program *kernel<sub>sim</sub>* is a learning-based high-order simulation program developed in C++ language as a SGeMS software plugin. The purpose of this program is to implement a high-order simulation software under the new established statistical learning framework. The aggregated kernel statistics are used to incorporate the high-order spatial information at multiple scales from different sources. The statistical learning framework for high-order simulation and kernelized learning algorithm can be referred to Yao et al. (2019). The spatial Legendre moment kernel originates from a new computational model of high-order simulation in Yao et al. (2018). The concept of aggregated kernel statistics is referred to Yao et al. (2020b,a).

## 2 Parameters

The main program can be run as a SGeMS plugin and the algorithm can be selected from the `Algorithm` panel in SGeMS. The parameter input is shown as Fig. 1 and the parameter description can be seen in Table 1. The application window in SGeMS is shown in Fig. 2.

Figure 1: Parameter input

Table 1: Parameters description

Parameter	Range
Maximum order of Legendre polynomials	between 10 ~ 20
Maximum number of conditioning data	10 ~ 30
Number of replicates from the TI	-1: take all the replicates n; 0: n replicates from the TI
Hard data usage	0: only use hard data 1: incorporate both the hard data and the TI -1: not using the hard data (only use the TI)
Angle tolerance	15° ~ 45°
Lag tolerance	Application dependent
Bandwidth	Application dependent
Dimensions of searching window	Application dependent
Number of prototype distributions	10 ~ 20
Number of divisions on the interval	100 ~ 200
Scale parameter of the prototype distribution	0.01 ~ 0.05

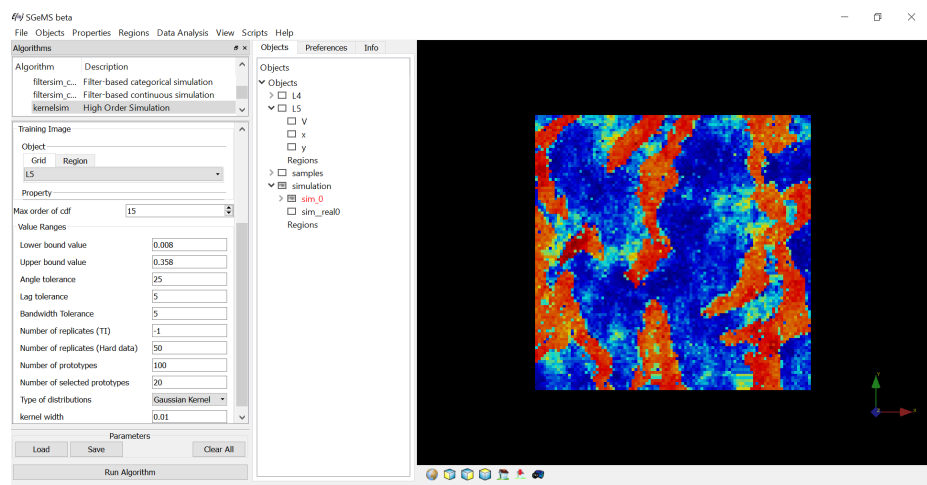


Figure 2: Application window

## References

- Yao, L., Dimitrakopoulos, R., and Gamache, M. (2018). A new computational model of high-order stochastic simulation based on spatial legendre moments. *Mathematical Geosciences*, 50(8):929–960.
- Yao, L., Dimitrakopoulos, R., and Gamache, M. (2019). High-order sequential simulation via statistical learning in reproducing kernel hilbert space. *Mathematical Geosciences*.
- Yao, L., Dimitrakopoulos, R., and Gamache, M. (2020a). Learning high-order spatial statistics at multiple scales: a kernel-based stochastic simulation algorithm and its implementation. *Computers & Geosciences*. (Submitted).
- Yao, L., Dimitrakopoulos, R., and Gamache, M. (2020b). Training-image-free high-order stochastic simulation based on aggregated kernel statistics. *Mathematical Geosciences*. (Submitted).