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National Technical University of Athens

School of Civil Engineering

Acad. Year: 2021-2022

**Course: Data-driven models in engineering applications**

1st Assignment

A) Consider the following stochastic field:

where is a zero-mean stationary Gaussian field with unit variance and . The autocorrelation function for is .

1. *Use the Karhunen-Loeve series expansion method to generate N=5000 realizations of the field E(x).*
2. *Justify the number of terms you retained in the KL-expansion.*
3. *Calculate the ensemble average and the ensemble variance from these realizations. To which values would they converge as we increase the number N of realizations?*

B) Consider the zero-mean Gaussian process , (sec), which has the following one-sided power-spectrum

1. *Use the Spectral Representation method to generate N=5000 time-histories (realizations) of the process .*
2. *Calculate the ensemble average and the ensemble variance from these time-histories. To which values would they converge as we increased the number N of realizations.*
3. *Calculate the temporal average and temporal variance from a single realization. What do you observe?*