VSB TECHNICAL UNIVERSITY OF OSTRAVA | FACULTY OF ELECTRICAL ENGINEERING AND COMPUTER SCIENCE

Ref. no.VSB/24/139087
vsboee2403F8C1

Bachelor Thesis Assignment

Student: **Michal Sedlář**

Study Programme: B0541A170008 Computational and Applied Mathematics

Title: Approximation of Karhunen-Loève Decomposition of Isotropic Gaussian Random Fields Using Orthogonal Polynomials and Gaussian Quadratures
Aproximace Karhunen-Loèveho rozkladu izotropních Gaussovských náhodných polí pomocí ortogonálních polynomů a Gaussových kvadratur

The thesis language: English

Description:

The goal of this thesis is to utilize orthogonal polynomials and Gaussian quadratures for the efficient approximation of the Karhunen-Loève decomposition of isotropic Gaussian random fields.

In the theoretical part, the student will familiarize themselves with the basic theory of orthogonal polynomials, including their evaluation using recursive formulas. The focus will then shift to the computation of Gaussian quadrature points and weights using the Golub-Welsch algorithm. The final part of the theoretical work is dedicated to the Karhunen-Loève decomposition of isotropic Gaussian random fields.

In the practical part, the student will concentrate on the implementation of the mentioned methods and their use in approximating the Karhunen-Loève decomposition.

References:

T.S. Chihara. (1978). An Introduction to Orthogonal Polynomials (Gordon and Breach, New York)
Gautschi, Walter. (2004). Orthogonal polynomials: computation and approximation. OUP Oxford.
Golub, G. H., & Welsch, J. H. (1969). Calculation of Gauss quadrature rules. Mathematics of computation, 23(106), 221-230.
Lord, G. J., Powell, C. E., & Shardlow, T. (2014). An Introduction to Computational Stochastic PDEs (Vol. 50). Cambridge University Press.

Extent and terms of a thesis are specified in directions for its elaboration that are opened to the public on the web sites of the faculty.

Supervisor: **Ing. Michal Béreš, Ph.D.**

Date of issue: 01.09.2024

Date of submission: 30.04.2025

Study programme guarantor: prof. RNDr. Jiří Bouchala, Ph.D.

In IS EDISON assigned: 22.11.2024 12:08:55