Prof. Dr.-Ing. habil. Falko Dressler
Telecommunication Networks – TKN

Technische Universität Berlin

Bachelor's / Master's Thesis

Impact of Network Size and Complexity on Full-body Molecular Communication Performance

Abstract

Modern medicine increasingly focuses on tailoring treatments and procedures to individual patients. As an extension of collecting heterogeneous data from patients, there is significant potential in integrating personalized simulations in the design of treatment options.

MEHLISSA is a simulation tool for in-body communication and disease modelling in the human circulatory system. To efficiently simulate real-world treatment and disease scenarios, we need a performant simulation environment. In this thesis, you will parallelise the existing simulation framework and use it to evaluate the impact of blood flow parameters on communication performance for multi-node frequency-modulated MC.

Content

The goal of this thesis is the parallelization of MEHLISSA 2.0 and the evaluation of the impact of network size and complexity with different flow parameters on the communication performance in full-body molecular communication. The code generated in this thesis will contribute to the open source gitHub project for MEHLISSA.

Requirements

Good practical skills in C++ and interest in physics and biology. Previous work with particle simulators and programming basics in MATLAB are helpful.

[1] R. Wendt and S. Fischer, "MEHLISSA: A Medical Holistic Simulation Architecture for Nanonetworks in Humans," in ACM NANOCOM 2020, ACM, Sep. 2020. DOI: 10.1145/3411295.3411305.

[2] L. Y. Debus, R. Wendt, S. Fischer, and F. Dressler, "MEHLISSA 2.0: Accelerating Full-body Molecular Communication Simulations," in 12th ACM International Conference on Nanoscale Computing and Communication (NANOCOM 2025), Poster Session, Chengdu, China: ACM, Oct. 2025, pp. 171–172. DOI: 10.1145/3760544.376564.

Contact:
Lisa Y. Debus: <debus@ccs-labs.org>

Website:
www.tkn.tu-berlin.de