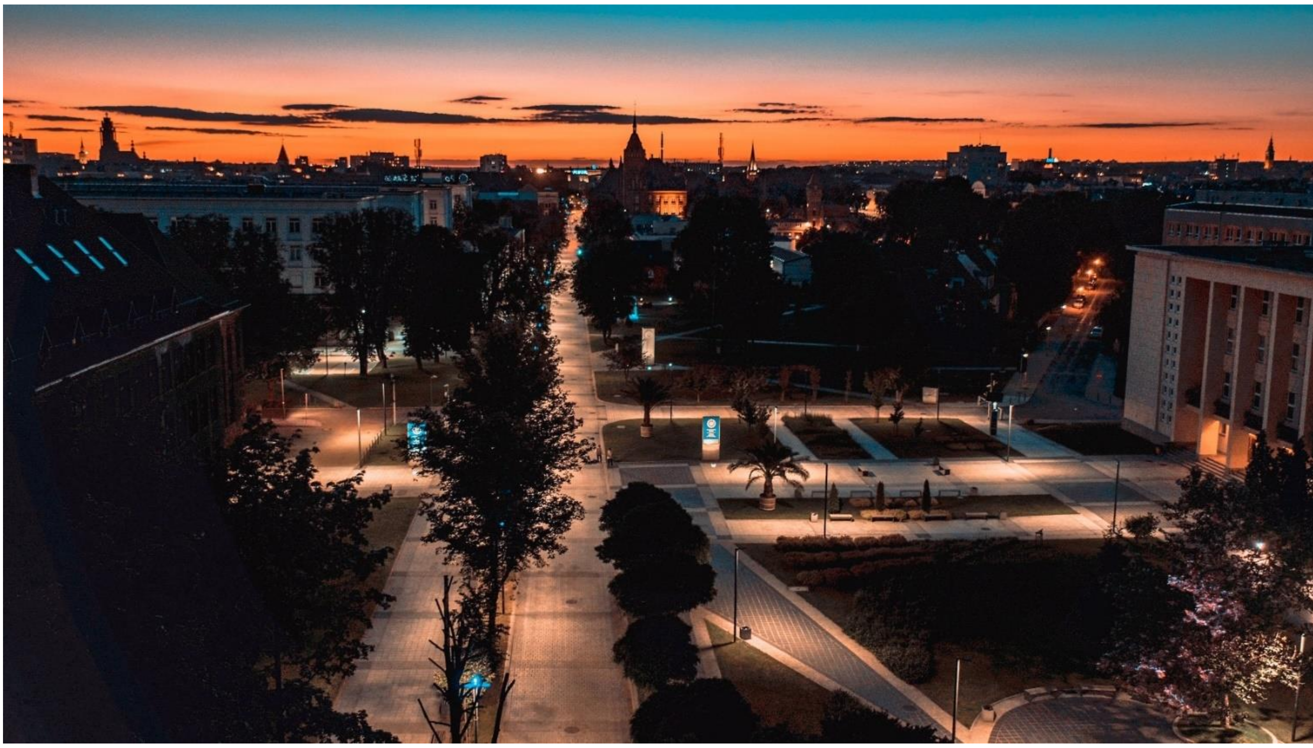
Summer School on vascular bioengineering

June 28th – July 1st, 2021

an online event @ Gliwice, PL



Silesian University of Technology (SUT), Gliwice, PL

Priority Research Area #1 Computational Oncology and Personalized Medicine

Norwegian University of Science and Technology (NTNU), Trondheim, NO

under auspices of

Committee of Biocybernetics and Biomedical Engineering of the Polish Academy of Sciences

Participation in the school is free of charge. **The school is addressed to PhD students and young researchers interested in vascular flow simulations.** English will be the working language. **The participants are required to have basic knowledge of PYTHON and MatLAB.**

The number of participants is limited. The number of participants cannot exceed 25 in the theoretical part (lectures) and 15 in the practical part of the school (hands-on training). Priority will be given to PhD students of SUT and NTNU. **The organizers reserve the right to select participants based on the application form submitted.**

For more details:
please click here

Registration form:
https://forms.office.com/r/nTD9kcNQvH

Event is organized within project ENTHRAL "Non-invasive in-vivo assessment human artery walls" funded from the Norwegian Financial Mechanism 2014-2021 under grant# UMO-2019/34/H/ST8/00624.

Norway grants

Silesian University of Technology

Summer School Program

1D model of the circulatory system

Instructor: **Dr. Jacob Sturdy, NTNU, Trondheim, NO**

3 h lectures + 3 h assignment to simulate examples and analyze the results according to theory.

Software: Anaconda Python. A Python environment file will be provided to install all necessary packages.

The vascular system consists of networks of tubular arteries and veins. A natural simplification from a full 3D description of the fluid and structure mechanics is to approximate each vessel as an axisymmetric tube.

Topics:

- derivation of a 1D-axisymmetric model for the blood vessels
- analysis of some properties of the resulting equations (e.g. wave propagation phenomena)
- presentation and numerical solver for arterial

Medical image segmentation

Instructors: **Dr. Krzysztof Psiuk-Maksymowicz, Dr. Damian Borys, SUT, Gliwice, PL**

2 hours of lectures + 4 hours on hands-on training.

Software: MatLAB.

Numerical biomedical simulations are conducted in geometrical domains whose shape is retrieved from medical images generated by computed tomography, magnetic resonance, and ultrasound. The 3D shapes obtained by segmentation is preprocessed to remove artifacts and meshed. The final distribution of the fields of interest within such domains are then obtained by discretization techniques such as velocity, concentration, stress and strains.

Topics:

- General principles of image processing,
- Characteristics of tomographic imaging, including angiography imaging.
- Overview of medical image segmentation techniques.
- Gaining skills of using some of segmentation techniques with special stress on technique applicable to the blood arteries segmentation.

Uncertainty quantification

Instructors: **Prof. Leif Hellevik, Dr. Jacob Sturdy NTNU, Trondheim, NO**

3 h lectures + 3 h assignment to setup and conduct an analysis of uncertainty and sensitivity of computationally simple model. Some example models will be prepared, but participants are welcome and encouraged to analyze a model of interest to themselves.

Software: Anaconda Python. A Python environment file will be provided to install all necessary packages.

While mathematical and computational models are powerful tools for analyzing and predicting the behavior of physical systems, their results are only as good as the input data we can acquire to define the simulation conditions - Garbage in, Garbage out. As practically all input data and many model parameters may only be known to some limited precision, in many medical contexts these may be known to the level of population variability, it is important to assess how the uncertainty about this data affects the results derived from the model.

Topics:

- basic theory of probabilistic uncertainty quantification (UQ) and variance based global sensitivity analysis (SA)
- Monte Carlo and polynomial chaos methods for performing UQSA
- hands on examples of performing these in Python

Ultrasound imaging

Instructor: **Dr Jan Juszczyk, SUT, Gliwice, PL**

2 hours of lectures, 4 hours on hands-on training

Software: MatLAB

Ultrasound imaging is a cheap and nonintrusive medical imaging modality of good resolution. The technique might be used to diagnose tumors, examine blood and urine flow and many other conditions.

Topics:

- physical principles of ultrasound imaging
- ultrasound probe types
- applications of ultrasound
- vascular imaging and flow imaging
- analysis of tissue elasticity in ultrasound (ultrasound elastography)

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