GPU technologies

High-Performance Computing (HPC) has been creeping into our everyday lives over the past decade with the proliferation of graphics processing units (GPUs). Our research team works on computational software that uses graphics cards' performance in the most efficient way.

We developed a differential equation solver package (MPGOS) which is currently the best-performing solver among the available solutions.

MPGOS is available on www.gpuode.com

Our results can be applied:

- accelerate numerical flow simulations.
- accelerate optimization calculations.
- for high-performance computations of sonochemical reactions.
- for the efficient application of Deep Learning methods in flow simulations.

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Flow stability

In flow stability, we focus on the possibilities of delaying the laminar-turbulent transition to reduce the friction losses of streamlined bodies using miniature surface elements. Secondly, acoustic effects due to flow oscillations are modeled. These have an essential role in instrument design or in reducing flow-induced noise.

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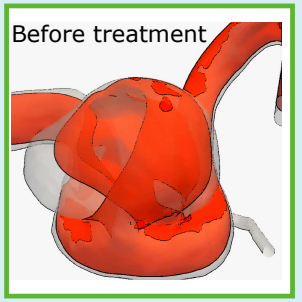
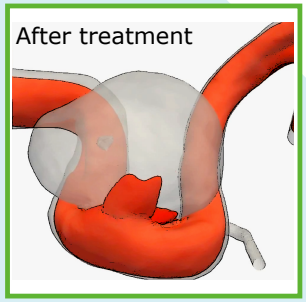
Hemodynamics





Nowadays, digital medicine plays a major role in understanding and treating diseases. Our department has more than 15 years of experience performing blood flow calculations. Currently, we are mainly involved in numerical flow analysis based on advanced medical image processing.

Our expertise:

- Numerical model generation from MR and CT images.
- 3D flow analysis of vascular diseases.
- Investigation of treatment modalities.
- Flow simulations in ANSYS and OpenFoam environments.
- Analysis of 1D vascular networks.

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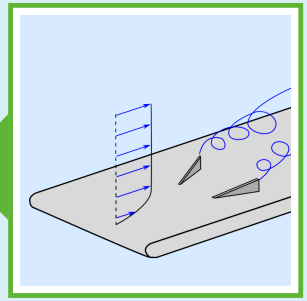
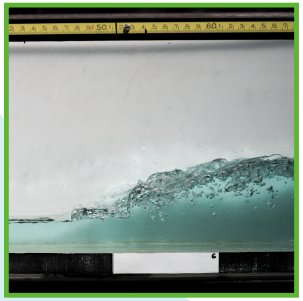
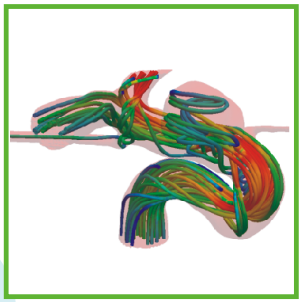
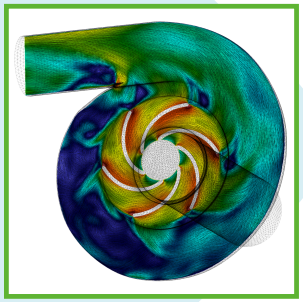
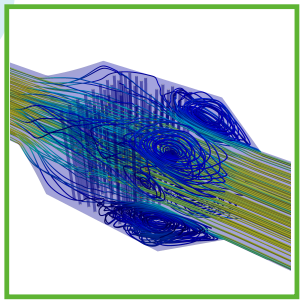


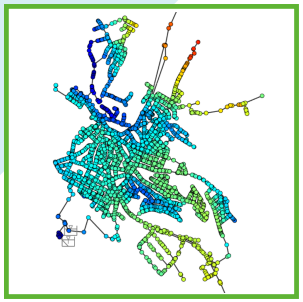
Department of Hydrodynamic Systems











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Hydraulic analysis of large-scale pipeline systems

For hydraulic calculations, we have developed an in-house made software called STACI. In the last decade, several studies in drinking water distribution networks (WDNs) have been carried out, such as:

- determination of classical hydraulic variables (pressure, flow rate, flow directions),
- robustness incrementation and vulnerability calculation against random pipe burst,
- capacityenhancementusingtopologyoptimization.
- estimation of water quality parameters (e.g. residence time, chlorine concentration),
- transient analysis of WDNs with high time resolution, e.g. pressure waves due to water hammer.

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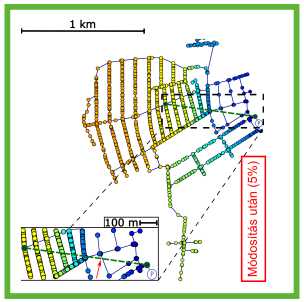

We also deal with sizing and testing of flow machinery systems, including:

- review of complete systems and measurement setups, expertise, consultancy,
- measurement and simulation of individual system components (e.g. elbows, valves).

Dr. Péter Csizmadia (PhD)
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Fluid machinery

Our department is continuously involved in the design and measurement of fluid machines (pumps, fans, compressors) and in advisor tasks related to such machines (efficiency improvement, characteristic curves and/or suction capacity measurements, etc.).

Starting from an initial geometry defined by traditional, well-established design methods, numerical flow simulations (CFD) are used to achieve the final optimised geometry, which is favourable from both a flow and an energy point of view. an

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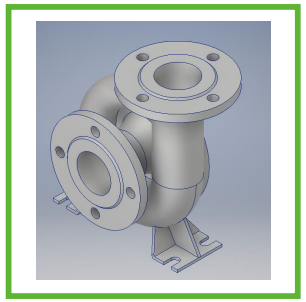
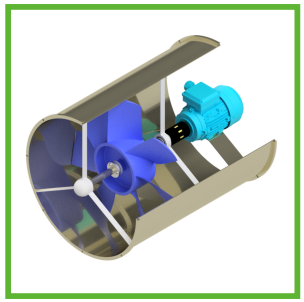


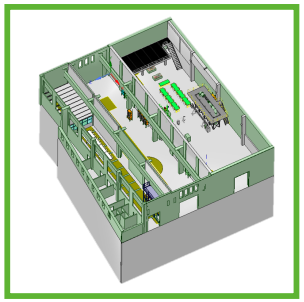


Chemical industry relations

Our research and development areas are related to the drinking and wastewater industries and other chemical technologies:

- numerical and experimental analysis of no-Newtonianfluidflowinmachinesandequipment,
- investigation of biofilm formation in drinking water networks,
- sonochemistry.

Infrastructure



Measurement, Laboratory

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Our water and air networks allow us to perform flow measurements over a wide range of flow rates, e.g., on gate valves, valves, and flow machines (fan, pump, etc.). We perform measurements for prototype validation and calibration to support expertise.

Moreover, our laboratory offers the chance to investigate flow phenomena in our unique cavitation channel, open-surface water channels, and pools, even with LDA measuring instruments.

The large available laboratory area (approx. 900 m2) and ceiling height also allow the construction and operation of individual, large measurement setups.

Informatics, computer science

16-core Workstation with 64 GB of memory for CFD computation of industrial and research tasks, equipped with video cards for GPU technologies.

64-core AMD EPYC server with 256 GB of memory to perform high-computational simulations

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