IHPC National Competence Center for HPC & AI in Iceland

EuroHPC Joint Undertaking

EURO²

Co-funded by the European Union

17th Icelandic HPC Community Workshop

Gróska, Bjargargötu 1, 102 Reykjavik – Entrance A, 1st Floor, Room Fenjamýri

9th October 2024 – 5:00 – 7:00 p.m. GMT

Background

The Icelandic High-Performance Computing (IHPC) activities are increasing in academia and industry that also includes related areas such as Artificial Intelligence (AI), Machine Learning (ML), Data Analytics, and Data Sciences. As a result, the IHPC community members created Icelandic Simulation and Data Labs (SDLs)[1], including academic and industrial partners. They form together in a bottom-up fashion the IHPC National Competence Center for HPC & AI in Iceland partly funded by the EuroHPC Joint Undertaking EuroCC project. The IHPC community seeks more collaborations and new members. Based on our successful previous IHPC workshops, we continue with bi-monthly workshops.

Objectives

This workshop aims to bring together a diverse group of Icelandic and international stakeholders to discuss the role of HPC and related areas within Iceland without losing sight of its international links.
The specific objectives of the workshop are to:

- **Document competencies, achievements, activities, and lessons learnt** from participating stakeholders of Icelandic HPC efforts and associated international activities.
- **Perform community building** in developing new successful joint activities between academia and industry, potentially creating new joint Simulation and Data Labs or collaborations.
- **Identify best practices and core principles with a set of recommendations** for developing the future Icelandic HPC ecosystem, including necessary skills, funding opportunities, applications, Centre of Excellences, community events, and sustainable infrastructure developments.

Participants

Approximately 35-40 participants from Iceland, Germany, and the USA. Participants will include:

- Selected Icelandic companies and SMEs from different sectors with interest in HPC & AI
- Academic representatives from the University of Iceland and Simulation and Data Labs
- The Icelandic Center for Research (Rannís), Startup Iceland, and Icelandic Technology Clusters
- US company that forms government, industry, and academic cooperative research coalitions

Output

The following outputs are expected:

- A short synthesis paper that documents Icelandic competencies, field experiences and achievements in using and/or offerings HPC & AI solutions and consideration of 'best practices'
- Update on a strategy paper responding to HPC & AI issues and challenges identified during the workshop, including potential options for jointly engaging in EuroHPC funding opportunities
    - Strengthened informal networks and transfer of experiences and lessons learnt

[1] Icelandic HPC (IHPC) Community Web page, Online: https://www.ihpc.is/

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Agenda draft (order of speakers & timing subject to change):

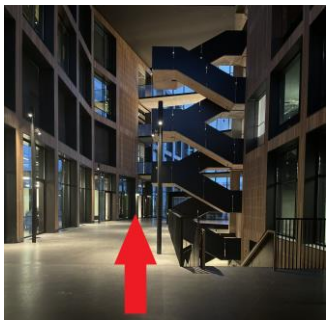
5:00 – 5:15	**Informal Welcome – Participant Introduction & Discussions** (Coffee/Tea/Refreshments, Snacks, and Sandwiches available)	All
5:15 – 5:20	Welcome Address - 17th IHPC Workshop & Overview	**Prof. Dr. Morris Riedel** (University of Iceland)
5:20 - 5:40	**Individual three-dimensional spatial auditory displays for immersive virtual environments** Binaural sound rendering techniques typically rely on the use of Head-Related Transfer Functions (HRTFs), i.e., filters that capture the acoustic effects of the human head. HRTFs allow accurate simulation of the signal that arrives at the entrance of the ear canal as a function of the spatial location of the sound source. By processing a desired monophonic sound signal with a pair of individual HRTFs, authentic 3D sound experiences can virtually take place. However, obtaining individual HRTF data is only possible with dedicated research facilities and invasive and/or strenuous recording procedures. Therefore, studying and modelling the relationship between anthropometric features and HRTFs is a desirable step towards providing accurate 3D auditory displays to anyone. In this talk I will give a brief introduction on binaural sound perception and rendering and then present some highlights of the project IT'S A DIVE, in which between 2019-2021 we developed innovative techniques for HRTF individualization based on a blend of traditional signal processing techniques, machine learning algorithms, and physically inspired models of sound propagation within the ear.	**Simone Spagnol** (Iuav University of Venice)
5:40 - 5:45	Q & A	All
5:45 - 6:05	**Stable and structure preserving formulations for model order reduction of fast wave-based room acoustic simulations in time-domain.** Model order reduction (MOR) is a powerful technique for accelerating computationally intensive simulations of wave propagation in the time domain. However, conventional MOR methods often suffer from stability issues, limiting their applicability. In the talk, I will first introduce the stability problem of MOR that arises when it is built upon the result from a long run acoustic simulation by highlighting how the structure of the system is lost. To fairly demonstrate the problem with preserving the structure, a stability analysis will be presented where the eigen values of the system operators will be compared against the stability region of the time-stepping scheme used for the simulations. At the end, the results of the conventional, unstable MOR technique will be compared with novel structure-preserving formulations for stable MOR of the cases of perfectly reflecting, frequency dependent and frequency independent impedance boundary conditions.	**Satish Kumar Bonthu** (University of Iceland)
6:05 - 6:10	Q & A	All

6:10 - 6:25	**Investigating the Effect of Anthropometric Properties on Individualized Head-Related Transfer Functions via Machine Learning.** Spatial audio systems are designed to convey location information to the listener by producing sounds that seem to come from a given direction. To operate properly, these systems need a good estimate of the listener's head-related transfer function (HRTF), which characterizes how incoming sound waves are transformed when interacting with the listener's body. Producing this estimate from easily collectible data is a field of active research, which this research project intends to advance. One of the major problems with research in this field is the inability to perform controlled experiments. Human pinnæ are highly variable, and it is virtually impossible to find a series of people that have pinnæ which vary in only one key dimension. To combat this problem, Eric will measure the HRTFs that correspond to series of synthetic ears. This new data will be provided to the research community to analyze the effect of individual anthropometric properties on the HRTF. Eric will also use this new data to train a machine-learning model which can estimate an individual's HRTF from 3D scan data; this promises to be a significantly more accessible procedure than the current standard of direct HRTF measurement in a specialized facility.	**Eric Michael Sumner** (University of Iceland)
6:25 - 6:30	Q & A	All
6:30 - 6:40	**Acoustic research presentation – subjects & facilities.**	**Rúnar Unnþórsson** (University of Iceland)
6:40 - 6:45	Q & A	All
6:45 - 6:55	**EDIH/NCC activities with the SEM Treble - closing workshop.**	**Morris Riedel** (University of Iceland)
6:55 - 7:00	Q & A	All

Workshop Location
Address: Gróska, Bjargargötu 1, 102 Reykjavik, Iceland[2]
Entrance A, 1st Floor, Room Fenjamýri

Gróska Outside

Gróska 1st Floor



Online Event Information & Previous IHPC Events:
Check out our IHPC Community Web page, Online: https://www.ihpc.is/

Workshop Organization:
Prof. Dr. -Ing. Morris Riedel, IHPC National Competence Center for HPC & AI (morris@hi.is)

Sigríður Daney Sigurðardóttir, Assistant to Prof. Dr. – ing. M. Riedel (sdaney@his.is)

[2] Gróska Building in the Science park, Online: https://groska.is/en/home/