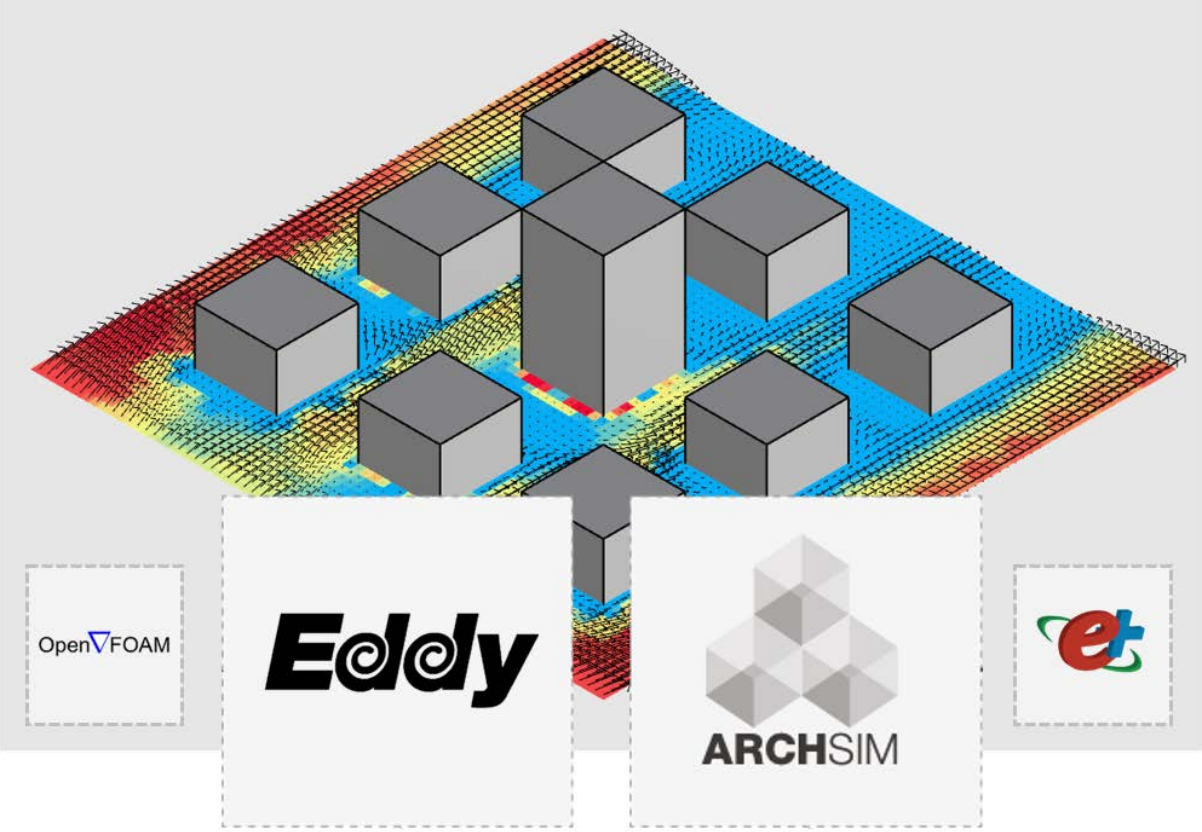

Title of workshop *

Natural ventilation prediction in and around buildings using Eddy and Archsim

Description of workshop *

Participants will learn modeling approaches to simulate airflow around and through buildings to inform Building Energy Models (BEMs). The two simulation tools used in this workshop are OpenFoam and EnergyPlus through Eddy and Archsim, which enable the participants to run BEMs coupled with accurate ventilation boundary conditions provided by Computational Fluid Dynamics (CFD). It is recommended that participants have good understanding of energy modeling, CAD modeling with Rhino and Grasshopper.

The participants will be provided with an overview about natural ventilation methods and their potential to reduce cooling loads in different climate zones. First, the workshop will motivate the use of CFD to provide natural ventilation input for Archsim. To facilitate that, the workshop will cover the available methods to model natural ventilation with Archsim such as the *(1) Design Flow Rate*, *(2) Airflow Networks with automatic pressure coefficient calculation*, *(3) Airflow Networks with custom pressure coefficient input*, and *(4) custom scheduled mass flow rates*.

After exploring the natural ventilation capabilities of Archsim, the participants will be introduced to Eddy, a Grasshopper plugin that streamlines CFD workflows to incorporate airflow analysis into architectural design. The theory and practical approaches for analytical pressure coefficient calculation and closed / open CFD simulations will be covered. By using Eddy, the participants will run both a whole-domain and a domain-decoupled CFD simulation for a single example building geometry and compare the results against literature values. Second, the participants will run the same simulation including contextual geometries to analyse the change in flow and pressure coefficient distributions. As a third step, the participants are encouraged to run a CFD simulation of a (simple) building of their choice and couple the results with Archsim to estimate the natural ventilation potential.

At the end of the workshop, the participants will have gained hands-on experience in linking CFD simulations with BEMs using Archsim and Eddy. Further, the participants gained domain knowledge on the sensitivity of airflow simulations with respect to contextual geometries and which BEM modeling techniques to use in such cases.

Workshop duration *

Half-day

Target audience *

Students and practitioners who have advanced expertise in building energy simulation and Rhino/Grasshopper are welcome to join the workshop.

Number of participants *

15

Participant requirements *

Laptops with Windows 10(!) and Rhino 5 / Grasshopper and at least 10 GB remaining space on the HDD.

Eddy and Archsim installers and free trial licenses will be provided.

Technical requirements *

Internet access / projector

BIOS

Patrick Kastner is an environmental engineer who holds an MSc in Sustainable Building Technology from the TU Munich and a BSc in Energy Engineering from FAU Erlangen-Nuremberg. Additionally, he participated in the Honors program at the Center for Digital Technology and Management in Munich. Patrick's research expertise lies in Computational Fluid Dynamics and Building Energy Simulation. Currently, he works on streamlining CFD workflows at the Environmental System Lab at Cornell University. While pursuing his degrees in Germany, Patrick gained experience while working for Transsolar Energietechnik GmbH, the Fraunhofer IISB, and a number of other firms focusing on project development in the energy sector.

Timur Dogan is an Assistant-Professor at Cornell Architecture. His research expertise is in environmental modeling such as daylight, comfort and energy as well as performance driven design workflows at urban and architectural scales. His work empowers architects and urban designers to optimize their design proposals. Dogan holds a PhD from MIT, a MDes from the Harvard GSD and a Dipl.-Ing. in Architecture with distinction from the TU-Darmstadt, where he was a fellow of the DAAD. He has released software tools (solemma.net, urbanmodeling.net) with thousands of users across leading engineering firms, architectural practices and universities. As part of Solemma, he also organizes annual symposia with over a hundred participants, workshops and professional training to enhance impact and to build a community.