Investigation of Convective Heat Transfer in the Surface Boundary Layers of Building Envelopes by Means of a Computational Analysis of Wind Tunnel Experiments

Jan Kočí[1, S, C]

[1]*Faculty of Civil Engineering, The Czech Technical University in Prague, Praha, Czechia*
jan.koci@fsv.cvut.cz

In this contribution, transport phenomena in boundary layers at the building facades and their effect on energy performance of buildings will be investigated using a combined computational-experimental approach. The idea of the project is to contribute to the current state of the art by identifying new correlations using advanced parameters such as relative humidity, wind direction, and surface roughness, as well as emphasizing the energy aspect of the appropriate description of transport processes in boundary layers. To achieve this, the heat transfer in the mixed velocity-thermal boundary layer near the building envelope surfaces will be analyzed and convective heat transfer coefficients for various types of building envelope surfaces will be determined under different environmental conditions. The experimental works will be carried out in the closed-circuit climatic wind tunnel, allowing to create an environment with well-fitted conditions that include wind with controlled wind effects, temperature, relative humidity, rain conditions, and heat radiation. The outputs obtained from the proposed approach will be used in energy simulation models and heat transfer simulations to achieve a higher accuracy than the standardized methods. The determination of convective heat transfer correlations will benefit from several features that are omitted in current standards but will be included in the new correlations, namely the effects of building envelope surface roughness, air temperature, temperature differences, relative humidity, and wind velocity and air flow regime. The final paper submitted to the conference will present and discuss some of the results obtained during the solution of the above-described research project.