Interactive High-Performance Computing: Coupling a Thermoregulation Model to a CFD Code

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ABSTRACT

Nowadays, computers tend to get faster and more powerful, and are able to solve problems deemed unsolvable a decade ago. Especially in the field of civil engineering, problems involving computational fluid dynamics (CFD) are requiring a huge computational effort. Unfortunately, even the most powerful supercomputers are not able to solve a thermal CFD simulation of a complete building or even a room on a whole year basis, which would be necessary for thermal comfort predictions or an estimation of energy consumption.

Thus, different approaches have to be used in order to obtain results on a whole year basis, such as zonal models, based on a coarse space and time discretisation. These results can then be used to act as boundary conditions for a highly detailed CFD analysis computed at certain characteristic snapshots in time, in order to get a better understanding of the internal airflow patterns in rooms, for example.

Furthermore, the thermal behaviour of occupants can be modelled in detail by a human thermoregulation model, such as the model described by Fiala et al [1]. The obtained surface temperatures according to the model applied are coupled to the CFD simulation in order to obtain more accurate solutions for the CFD snapshots.

We will present coupling procedures from a human thermoregulation model to a CFD code. As code, an in-house CFD code specifically designed with parallel systems in mind, and described in [2] will be applied. Example computations will be presented, highlighting the coupling effects, as well as first validation results. Furthermore, an advanced, interactive data exploration system will be presented, allowing an interactive visualisation to explore simulation results during runtime, providing already preliminary views during computation time to scientists and engineers.

REFERENCES

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