# An adaptive modelling approach for energetic building simulation, based on Modelica

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The presentation describes the development of an energetic building model in Modelica, in which the spatial resolution (0D, 1D, 3D) and the used physical model (pure thermal or hygro-thermal approach) can be flexibly adapted to the simulation problem [1]. Through the use of Modelica's object-oriented approach different spatial resolutions (0D, 1D, 3D) for the individual parts of a multi-zone-building model are feasible as well as mixed thermal and hygro-thermal building models:

**Level of detail 0D:** the adaptive building model works in a strongly simplified and abstracted configuration, which leads to numerical fast calculations. A typical application would be the parallel calculation of the thermal energy demand of huge number of single buildings of a district. **Level**

**of detail 1D:** in this case the adaptive building model uses more spatially resolved algorithms and models and also more simulation time for a single building. A typical application are multi-zone-building models, which provide spatial thermal energy demand, air temperatures, air moistures and also the air exchange between the single thermal zones of a complex building. **Level of**

**detail 3D:** the most advance configuration consists in a spatially resolved room model, which describes the three-dimensional air flow within a room volume, the geometrical long-wave and shortwave radiation distribution and also the multidimensional heat transport within the building construction. For example, this model is able to calculate the location-dependent thermal comfort within a room.

For the realization of such a flexible modelling approach an extensible and modular building model architecture was developed in Modelica. This includes respective model interfaces and generic and adaptive sub-component models. The presentation describes the underlying model architecture and also case studies, which demonstrate the potential of the adaptive modelling approach.

## References

[1] C. Nytsch-Geusen and K. Mucha and A. Inderfurth and J. Rädler, *Entwicklung eines räumlich und physikalisch adaptiven energetischen Gebäudemodells in Modelica*. Proceedings of the BAUSIM 2014 Conference, September 22-24, 2014, Aachen, Germany.