phenomenologic analysis of heating systems by object-oriented model design and simulation

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For a correct energy cost distribution of heating systems, the consumed quantities of heat from all provided users have to be measured as exactly as possible. Using heat cost distribution systems at radiators requires the knowledge of special rating factors. Measurement of these factors comes up with immense costs. The scope of an industrial co-operation was to work out and realise new methods for an effective reduction of the expense by the usage of simulation technology. To solve this problem, a sufficient mathematical model of the concerning physical process is required.

The main problem is a qualified description of the subsystem radiator. This model design requires a new approach to consider all the different radiator types easily. Similar radiator types can be merged into classes to reduce the absolute number of model descriptions. The results of the theoretical analysis of all relevant heat transfer phenomena and from detailed CFD simulation runs will be used to derive an adequate model description based on an exponential approach for every abstracted class.

This class concept can easily be realised by the object oriented model description tool *CAMex* (*C*omputer *A*ided *M*odeling for *ex*perimental design) which was developed at the department of control theory at the university of Paderborn. The basic elements of object orientation are methods for process structure analysis by abstraction, building up classes and special mechanisms to inherit class attributes. With hierarchical process decomposition into its subsystems (substantial abstraction) and the following analysis of the physical phenomena (phenomenologic abstraction), elemental model components will be defined on a level of high modularity with low abstraction. These components are aggregated automatically to the complex main process model for simulation. By following this concept, many radiator models can be generated quick and easily out of only a few elemental model components for each radiator class.