

The future for simulating district heating networks?

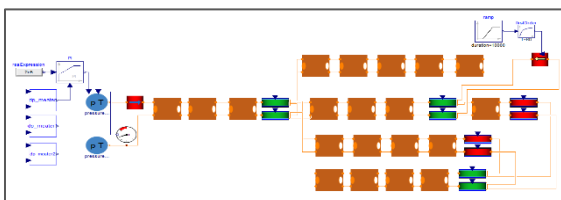
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A district heating network contains a lot of pipes, consumer and producers. To simulate such a network models were created in the Modelica language. The results show it is possible to do dynamic simulation of district heating network using the Modelica language.

The current simulation tools often use simplifications such as a fixed return temperature. With the use of Modelica models the user can create models that have the complexity that is desired. The models can be used to increase the efficiency of an existing network or used to plan a new network. T

The created models are put together in a complex network with 100 consumer models, 248 pipe models and two producers. The simulation was done for 24h and the time it took to complete a simulation was 100 seconds.

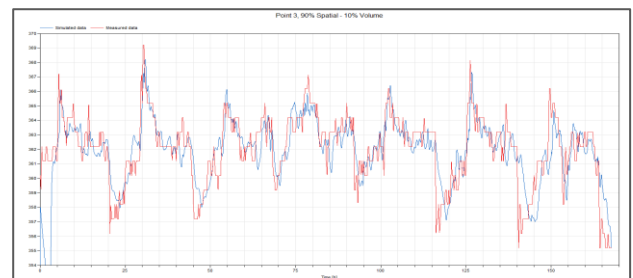


A simulation setup over a district heating network.

It did already exist a pipe model in the Modelica standard library however it is based on an unnecessary complex method for simulation of district heating networks. Instead a new pipe model was created, the new pipe model is based on a plug flow approach. In plug flow it is assumed that the velocity of the fluid is the same for any cross-section of a pipe. A volume model was introduced into the model to

simulate mixing. The new pipe rapidly show major improvements. A simulation of four consumers using the MSL pipe was done just under 200 seconds, however with the plug-flow pipe the simulation time was reduced to four seconds. And the results of the simulation was the same. Comparing this to the complex network the new pipes can do simulation of 25 times as many consumer models and doing so half of the simulation time.

The pipe also introduce a method to calculate the heat loss. The implementation is tested against data from an existing district heating network.



Comparisons of simulated and measured temperature

The result show that the simulated (blue) is close to the measured value (red). The start temperature was around 372K.

The consumer and producer models that are created are more used more as a base that can later be added complexity into and depending on what result is desired the models can easily be customized. The new models give the user a lot of room to work with, and a lot of possibly to customize the models.