Modeling thermally active building components using space mapping

In order to efficiently implement thermally active building components in new buildings, it is necessary to evaluate the thermal interaction between them and other building components. Applying parameter investigation or numerical optimization methods to a differential-algebraic (DAE) model of a building provides a systematic way of estimating efficient building designs. However, using detailed numerical calculations of the components in the building is a time-consuming process, which may become prohibitive if the DAE model is to be used for parameter variation or optimization. Unfortunately, simplified models of the components do not always provide useful solutions, since they are not always able to reproduce the correct thermal behavior. The space mapping technique transforms a simplified, but computationally inexpensive model, in order to align it with a detailed model or measurements. This paper describes the principle of the space mapping technique, and introduces a simple space mapping technique. The technique is applied to a lumped parameter model of a thermo active component, which provides a model of the thermal performance of the component as a function of two design parameters. The technique significantly reduces the modeling error.

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