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DYNAMIC U VALUE MEASUREMENT FOR INDOOR TEMPERATURE PREDICTION WITH NN

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Abstract – Nowadays, monitoring and automated control are key for the power-efficient and comfortable use of buildings. As the demand for the indoor climate grows, the complexity of building control increases due to the increased number of controlled systems within the building. Therefore, control methods capable of assessing the dynamics of a task and controlling a building independently, are gaining popularity. One of these methods is a model-based predictive control, the energy efficiency of which is directly dependent on the accuracy of predictions of the state of the building. To analyse changes in the dynamics of the internal climate of a building caused by temperature changes, a relatively short history of measurements is needed. However, the analysis of changes in structural properties caused by moisture transfer requires much longer-term historical data. It is known that even neural network architectures with large core memories such as Long Short-Term memory could lose information on large time-series data. In addition, from mathematical point of view, moisture transfer is more complex than heat transfer. As a result, the approximating function for a neural network becomes more complicated, which leads to a decrease in energy performance. To solve this problem, a pre-processing technique to obtain the U value in real time is introduced. The results of a numerical simulation in WUFI6, verified by measurements, showed that the U value of an experimental construction could change by ~10 % due to moisture transfer. The experiments with 3-year monitoring data showed that usage of the proposed method in some cases reduces the average mean squared error of neural network in indoor climate forecast by ~8 %.

Keywords – Artificial intelligence; model-based predictive control; moisture; neural networks; U value; WUFI

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