Séminaire du CETHIL

Jeudi 30/03/2017 à 13h30

Salle 230, bât. Carnot

The use of black box models to predict hygrothermal behavior of building structures and soils

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Sujet du séminaire

This presentation addresses two distinct approaches to predict hygrothermal variations based on black box models. The first one is related to soils and the second one is associated to building structures. Studies on dynamics of temperature and moisture content distributions in porous soils have provided important insight on their effect on the building hygrothermal behavior, where the interaction between both building and soil can contribute to reduce building thermal gains or losses. A great variety of mathematical models to predict thermal and moisture content profiles in porous media have been presented in the literature. Most of those models are based on analysis of multilayer measurements or on Fourier analysis. The development and validation of such mathematical models facilitate the understanding of heat and moisture flows at different soil depths. In this research, a radial basis function neural network (RBF-NN) approach, combined with Gath-Geva clustering method in order to predict the temperature and moisture content profiles in soils, has been presented. Simulation results indicate the potentialities of the RBF-NNs to learn, for the one step ahead identification, the behavior of temperature and moisture content profiles in the media at various depths. The second approach, which is directly related to building materials, threats the problem associated to humidity accumulation in building corners. These regions are still barely explored due to modeling complexity, high computer run time, numerical divergence, and highly moisture-dependent properties. In this way, an alternative to predict temperature, vapor pressure, and moisture content profiles in specific points where moisture can be easily accumulated, increasing mould growth risks and/or causing structural damage to the building, has been presented. Based on a Takagi–Sugeno fuzzy inference system with a multiple-input, single-output (MISO) structure, combined with subtractive clustering method and Kalman filter to enhance its performance, results have revealed a faster approach than the numerical model in predicting temperature, relative humidity, and vapor pressure on specific nodes. Finally, to conclude this presentation, perspectives for cooperative researches during 2017 are exposed.

This presentation complies with a project funded by a grant from Région Auvergne Rhône-Alpes.

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