Dynamic thermal response of low-energy residential buildings based on in-wall measurements

This study analysed the dynamic thermal response of a low-energy building using measurement data from an apartment block in Copenhagen, Denmark. Measurements were collected during February and July 2018 on space heating energy use, set-points, room air temperature and temperature from sensors integrated inside concrete elements, i.e. internal walls and ceiling, at different heights and depths. The heating system was controlled by the occupants. During February, there were unusually high set-points for some days and a regular heating pattern for some other days. Overheating was observed during July. A considerable effect of solar gain was observed both during winter and summer months. The room air temperature fluctuations were observed at a certain extent inside the concrete elements; higher in the non-load-bearing internal wall, followed by the load-bearing internal wall and lastly by the ceiling. The phenomenon of delayed thermal response of the concrete elements was observed. All internal concrete masses examined may be regarded as active elements and can contribute to the physically available heat storage potential of the building. The study provides deep insight into the thermal response of concrete elements in low-energy residential buildings, which should be considered when planning a flexible space heating energy use.