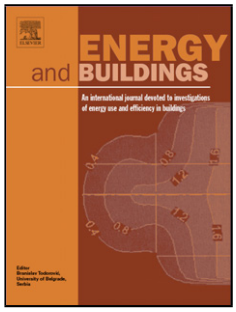

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Temperature and humidity adaptive control in multi-enclosed thermal zones under unexpected external disturbances

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ABSTRACT

In this paper a new dynamic simulation model for the building energy performance analysis of multi-enclosed thermal zones, where rigid air temperature and humidity conditions must be kept, is presented. The model was implemented in a suitable computer code (DETECt 2.3.1) developed for research scopes. Such simulation model allows the hygrothermal analysis of buildings with multi-enclosed thermal zones surrounded by larger ones (e.g. display glass cases with valuable artefacts in museum halls, neonatal intensive care units for premature and full-term newborn babies in hospitals wards, etc.). For this purpose, a novel control algorithm, based on a model reference adaptive control scheme, enabling the online adaptation of the control gains, is implemented. Rigid air temperature and humidity conditions can be guaranteed also in case of sudden and rapid variability of hygrothermal loads. Through such new tool innovative techniques and operative strategies for obtaining energy efficiency and indoor comfort of special building spaces can be studied.

In order to show the capabilities of the tool and the robustness of the adaptive algorithm, as well as the potentiality of the proposed multidisciplinary approach to the energy-related behaviour in