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Analysis of Thermal Comfort in Educational Buildings Using Computer Simulation: A Case Study in Federal University of Parana, Brazil

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Abstract : A prerequisite of any building design is to provide security to the users, taking the climate and its physical and physical-geometrical variables into account. It is also important to highlight the relevance of the right material elements, which arise between the person and the agent, and must provide improved thermal comfort conditions and low environmental impact. Furthermore, technology is constantly advancing, as well as computational simulations for projects, and they should be used to develop sustainable building and to provide higher quality of life for its users. In relation to comfort, the more satisfied the building users are, the better their intellectual performance will be. Based on that, the study of thermal comfort in educational buildings is of relative relevance, since the thermal characteristics in these environments are of vital importance to all users. Moreover, educational buildings are large constructions and when they are poorly planned and executed they have negative impacts to the surrounding environment, as well as to the user satisfaction, throughout its whole life cycle. In this line of thought, to evaluate university classroom conditions, it was accomplished a detailed case study on the thermal comfort situation at Federal University of Parana (UFPR). The main goal of the study is to perform a thermal analysis in three classrooms at UFPR, in order to address the subjective and physical variables that influence thermal comfort inside the classroom. For the assessment of the subjective components, a questionnaire was applied in order to evaluate the reference for the local thermal conditions. Regarding the physical variables, it was carried out on-site measurements, which consist of performing measurements of air temperature and air humidity, both inside and outside the building, as well as meteorological variables, such as wind speed and direction, solar radiation and rainfall, collected from a weather station. Then, a computer simulation based on results from the EnergyPlus software to reproduce air temperature and air humidity values of the three classrooms studied was conducted. The EnergyPlus outputs were analyzed and compared with the on-site measurement results to be possible to come out with a conclusion related to the local thermal conditions. The methodological approach included in the study allowed a distinct perspective in an educational building to better understand the classroom thermal performance, as well as the reason of such behavior. Finally, the study induces a reflection about the importance of thermal comfort for educational buildings and propose thermal alternatives for future projects, as well as a discussion about the significant impact of using computer simulation on engineering solutions, in order to improve the thermal performance of UFPR's buildings.

Keywords : computer simulation, educational buildings, EnergyPlus, humidity, temperature, thermal comfort
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