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Energy and Comfort of a Thermal Chair: CFD and Field Test Studies

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Abstract. The energy performance and human thermal comfort of a thermally controlled chair was examined in an office in the UK through field test and Computational Fluid Dynamics (CFD). The aim of the study was to reduce the overall energy consumption of the office by reducing the air temperature by 3°C and to allow every occupant a degree of flexibility to find their own comfort through setting the temperature of a chair. To provide the balance between energy and comfort in the built environment is a challenging matter, as most buildings tend to be at the either end of the spectrum. This study investigated an approach to improve thermal comfort, while reducing the overall energy consumption of the building. In this study, a prototype of a thermal chair with user controls over the back and seat was designed. Users were provided an opportunity to change the temperature around their body parts (e.g. back and seat) to improve their overall thermal comfort through using a thermal chair. The results indicated higher user comfort of the users, while the CFD analysis of the thermal distributions. There was no significant increase in the overall energy performance of the building after using the chair, while comfort level and satisfaction of the occupants was improved up to 30%.

Keywords: Thermal Chair, Energy, Thermal Comfort, Thermal Control, Office