IOCIV 2026 Conference
The 1st International Online Conference on Inventions
25–26 June 2026 | Online
MDPI

Energy in Buildings and Comfort of the Occupants

Eusébio Z.E. Conceição (1,5); Margarida I.L. Conceição (2); Mª Inês L. Conceição (2); Mª Manuela J.R. Lúcio (1); João Gomes (3) and Hazim B. Awbi (4)

(1) FCT-Universidade do Algarve, Campus de Gambelas, 8005-139 Faro, Portugal
(2) Instituto Superior Técnico, Universidade de Lisboa, 1049-001 Lisboa, Portugal
(3) ISE ,Universidade do Algarve, 8005-139 Faro, Portugal
(4) University of Reading, Reading, RG6 6AW, United Kingdom
(5) ADAI, DEM, Universidade de Coimbra, Rua Luís Reis Santos, Pólo II, 3030-788 Coimbra, Portugal)

INTRODUCTION & AIM

Efficient design generation is key to the application of solar radiation in shopping centre buildings, particularly when renewable energy is intended to enhance occupant comfort.

Renewable energy is considered in the development and assessment of building design, thermal comfort, and indoor air quality in buildings with complex topology.

In this work, the building thermal response software is used. This software considers opaque bodies (grey) as internal and external bodies, transparent bodies (blue) as windows and doors, and roofs (red).

METHOD

In this numerical model, the energy and mass balance integral equations for the transparent and opaque building bodies are used to evaluate temperature and contaminant concentrations. In thermal comfort, the PMV and PPD indices are used. Indoor air quality is assessed based on carbon dioxide concentration.

A building with a complex topology, used as a shopping centre and equipped with internal greenhouses in the ceiling, will be analysed. The building has a circular configuration, featuring a central corridor (with a greenhouse in the ceiling) and stores on both sides.

BUILDING DESIGN

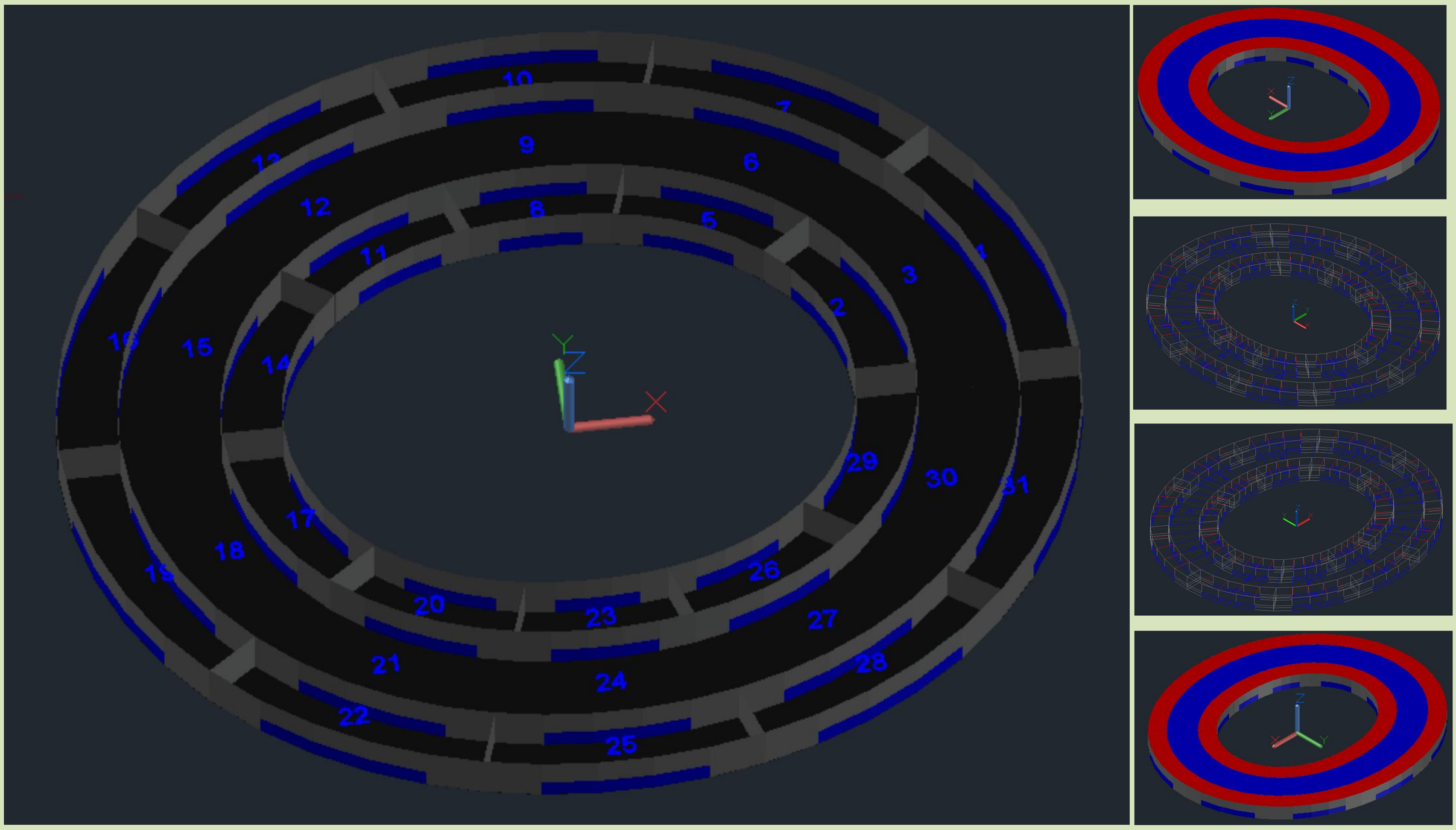

Figure. Opaque bodies (grey), as internal and external bodies, transparent bodies (blue) as windows and doors, and roofs (red).

CONCLUSIONS

The airflow is transported from the external environment to the central corridor and then to the stores on both sides. Indoor air quality is ensured by maintaining an acceptable airflow rate. The study was conducted under winter conditions in a Mediterranean environment. The greenhouse contributes to obtaining thermal comfort conditions both in the corridor and in stores.

FUTURE WORK

As future work, new passive ventilation systems will be developed for this building. These will be passive-alternative ventilation systems, such as cross ventilation, using the speed of the external wind, involving groups of three attached compartments: a central corridor and upstream and downstream compartments.