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Flow Regimes and Thermal Patterns in 15th Century BC Tombs of the Valley of Kings

Airflow characteristics in ventilated and air-conditioned spaces play an important role to attain comfort and hygiene conditions. This paper utilizes a 3D Computational Fluid Dynamics (CFD) model to assess the airflow characteristics in ventilated and air-conditioned archeological tombs of Egyptian Kings in the Valley of the Kings in Luxor, Egypt. It is found that the optimum airside design system can be attained, if the airflow is directed to pass all the enclosure areas before the extraction with careful selection of near wall velocities to avoid any wear or aberration of the tomb-wall paintings. Still all factors and evaluation indices have the shortage to describe the influence of the recirculation zones on the occupancy zone of the visitors and also on the fresh supplied air. To design an optimum HVAC airside system that provides comfort and air quality in the air-conditioned spaces with efficient energy consumption is a great challenge. Air conditioning can be identified as the conditioning of the air to maintain specific conditions of temperature, humidity, and dust level inside an enclosed space. The levels of the air conditions to be maintained are dictated by the local environment, type and number of visitors and required climate and the required visitors comfort and property reservation. The comfort air conditioning is defined as "the process of treating air to control simultaneously its temperature, humidity, cleanliness, and distribution to meet the comfort requirements of the occupants of the conditioned space". For the present work, following other earlier similar work , a numerical study is carried out to define the optimum airside design of the tombs air ventilation and conditioning systems, which provides the optimum comfort and healthy conditions with optimum energy utilization. The present work made use of packaged Computational Fluid Dynamics (CFD) programs. The present paper introduces a description of the computational solver and its validation with steady state results of the previous properly related literatures. Basically, airside design types are considered here for the tomb passage of King Ramsis VII, including different visitors (obstacles) alternative positioning to introduce the capability of the design to provide the optimum characteristics. The full description of the parametric cases' parameters is discussed later. The primary objective of the present work is to assess the airflow characteristics, thermal pattern and energy consumption in the different tomb ventilation configurations in view of basic known flow characteristics. The paper ends with a brief discussion and conclusion.The mode of evaluation should assess the airflow characteristics in any tomb passage according to its position in the enclosure and the thermal pattern and air quality.

Biography

Essam E Khalil is the Associate Professor of Mech Engineering in (1982). He is the Chairman of the National Ventilation Code Committee in (2005). He is the Consultant Editor of the Arabic Program of McGraw Hill Book Company(1983-1988). He is the Ashare Director –At-Large,USA,2016-2019.

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