Parametric investigation of solar chimney with new cooling tower integrated in a single room for New Assiut city, Egypt climate

Amr Sayed Hassan Abdallah • Yoshino Hiroshi • Tomonobu Goto • Napoleon Enteria • Magdy M. Radwan • M. Abdelsamei Eid

Abstract:

Houses in Egypt are often designed without taking the climate into account sufficiently. Consequently, new houses often have a poor indoor climate, which affects comfort, health and building efficiency. In hot and arid climates, passive cooling system employs non-mechanical procedures to maintain suitable indoor temperature. Thus, they have been increasing the influence of the traditional cooling concepts but with new technology. Therefore, these conditions encourage such a concept to enhance natural ventilation with evaporative cooling and save energy in the New Assiut city. In the present study, the effect of solar chimney parameters on wind tower parameters was numerically investigated as a second phase of the new integrated model. All the detailed mathematical equations and system description are presented in phase one. A numerical simulation is implemented in Transient systems simulation program-Conjunction of multizone infiltration specialists program softwares. The parametric studies of the integrated system in phase two were studied to achieve high performance with new compact small design especially for the hottest days in the summer season. The temperature and airflow rates are predicted iteratively taking into account the zone pressure and the pressure drop in the evaporative cooler component. The result shows that the system achieves nearly at least close to 80% acceptable comfort range according to Adaptive Comfort Standard of American Society of Heating, Refrigerating and Air-Conditioning Engineers with optimum ventilation rate 414 m3/h for the hottest day. The findings show that the system achieves high performance in the hottest day with small solar chimney dimension and is easy to integrate in the building envelope than the proposed system before parametric studies in phase one.

Keywords:

Passive cooling Solar chimney TRNSYS-COMIS Parametric investigation

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International Journal of Energy and Environmental Engineering, Springer, 5:92,
Experimental Study of Passive Air Condition System Integrated into a Single Room in Assiut, Egypt

Amr Sayed Hassan Abdallah

Abstract:

Cooling of buildings is an essential target for engineers and builders in the hot arid climate of Egypt. Performance of inclined solar chimney with passive cooling tower (SCPC) was studied. The system was integrated into a single room built in Assiut University (El-Gorib site) in Assiut, Egypt. Testing of indoor environment for the room with passive cooling was done during August and September 2015. A passive cooling technique was integrated inside a short wind tower made from expanded paper (wet pad) 0.1 m thick. A water tube was installed on the top of the expanded paper with small nozzles. Water is recirculated through the system using water pump. A reduction of room indoor temperature was observed with the integrated system (SCPC). There is a significant reduction of indoor temperature between 6 and 7 K due to passive cooling with surface temperature 19.4 °C for the cooling pad. The relative humidity did not exceed 57% most of the time. The maximum air speed inside the solar chimney was 3.5 m/s under the effect of a high solar radiation of 890 W/m2. The findings show that SCPC system achieves comfortable thermal conditions with a significant improvement in building energy conservation. The result of development this new cooling system helps to develop building code for low energy houses in Egypt and propose a new system to be integrated in the housing project of people with low income.

Keywords:

Inclined solar chimney; Passive cooling; Thermal comfort; Carbon dioxide concentration

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A new design of passive air condition integrated with solar chimney for hot arid region of Egypt

Amr Sayed Hassan Abdallah

Abstract:

Housing in Egypt consumes high energy for cooling. Bioclimatic building design is one of the strategies of sustainable development. This study aims to investigate the thermal performance and indoor air quality of solar chimney with passive cooling wind tower (SCPCW) on occupants comfort. Thermal performance of a full-scale SCPCW was experimentally investigated. The passive cooling design is integrated on the ceiling of 30m² test house. Monitoring of indoor environment was carried out over a period of 2 months in the summer season (August, September and early October) with a 2-min interval in order to calculate thermal comfort sensation, Predicted Mean Vote (PMV) and Predicted Percentage of Dissatisifed. The results show that outlet air temperature from the wind tower is 27.3°C. Also, the calculated PMV is within the recommended range (± 0.5

Keywords:

Passive air condition· Solar chimney· Occupant comfort· Thermal sensation

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تأثير النغمة الداخلية على النداء الحراري للغرف المطلة عليها في المباني الجامعية بصعيد مصر خلال الفترة الباردة: دراسة حالة (مبني كلية الزراعة بجامعة سوهاج الجديدة).
أ.د. عبد المنهل محمد علي /عمرو سيد حسن /ديناء أحمد

Abstract:

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New Passive Cooling as a Technique for Hot Arid Climate

Amr Sayed Hassan Abdallah

Abstract:

Cooling of buildings is an essential target for engineers and builders in the hot arid climate of Egypt. New cooling system was integrated into a single room built in Assiut University (El-Gorib site) in Assiut, Egypt. A passive cooling technique was integrated inside a short wind tower made from expanded paper (wet pad) 0.1 m thick. A water tube was installed on the top of the expanded paper with small nozzles. The results show that outlet air temperature from the wind tower is 27.3°C. The calculated predicted mean vote (PMV) is within the recommended range (0.5).

Keywords:

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Energy Systems and Environment-(Book chapter) , NULL , 15
Analysis of Thermal Comfort and Energy Consumption in Long Time Large Educational Halls (Studios), Assiut University, Egypt

Abdallah, Amr Sayed Hassan

Abstract:

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Keywords:

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Procedia Engineering, v 121, p 1674-1681
Thermal Monitoring and Evaluation of Indoor CO2 Concentration in Classrooms of Two Primary Governmental Schools in New Assiut City, Egypt

Hassan Abdallah, Amr Sayed

Abstract:

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Occupant Comfort and Indoor Temperature Reduction by Using Passive Air Conditioning System with Solar Chimney Concept in Hot Arid Climate

Hassan Abdallah, Amr Sayed

Abstract:

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The Impact of outdoor shading strategies on Student thermal comfort in Open Spaces Between Education Building

Amr Sayed Hassan Abdallah Sara Wael Husseina Mohamed Nayelb

Abstract:

The aim of this study is to evaluate and improve student thermal sensation in the open spaces of the Faculty of Engineering, Assiut University, Egypt using different shading strategies. Firstly, the thermal conditions of outdoor spaces were evaluated based on field measurements in different locations of shaded outdoor spaces between educational buildings within the Faculty of Engineering. Then, the microclimate model ENVI-met was applied to evaluate the impact of different shading scenarios on improving student thermal comfort. Also, the Thermal Sensation Vote (TSV) of the was studied by a questionnaire survey using the 118 effective questionnaire responses of the student sitting in the spaces between buildings. Hence, the results concluded that high air temperature is found in most outdoor open spaces, especially in the sitting area with low trees density and high Sky View Factor (SVF). Similar results were obtained by the TSV analysis. In addition, a significant reduction in the Predicted Mean Vote (PMV) values resulted from the ENVI-met simulation model with an average temperature difference of 0.7 °C due to increasing tree density for the main open space. Thus, it is recommended to increase greenery and tree density, to reduce heat stress and create student thermal comfort in outdoor.

Keywords:

Outdoor open space, Students thermal sensation, Assiut University, ENVI-met model.

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