NUMERICAL SIMULATION FOR THERMAL COMFORT USING CONDITIONED AIR THROUGH MIXING AND PERSONALIZED VENTILATION SYSTEMS IN FIELD ENVIRONMENTAL CHAMBER (FEC)

By

Eng. Hossam Awad El-Maghraby Abdelaal

A Thesis Submitted to the

Faculty of Engineering at Cairo University

in Partial Fulfillment of the Requirements for the Degree of

MASTER OF SCIENCE

In

MECHANICAL POWER ENGINEERING

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Key Words: Conditioned Air, Personalized Ventilation, Mixing Ventilation, Thermal Comfort, FEC, CFD

Summary:

Thermal comfort within a Field Environmental Chamber (FEC) office mockup was numerically simulated throughout the current study. The goal of this research was to determine the best scenario to provide conditioned supply of air and distribute it inside an office room by using Mixing Ventilation (MV) and Personalized Ventilation (PV) systems to create the best status of thermal comfort for a sitting occupant who is typing in front of a computer screen. Computational Fluid Dynamics (CFD) method was used and specifically ANSYS FLUENT 14.0 commercial package software to compare the thermal comfort conditions for the occupant with different strategies of air distribution with various flow rates either being used solely or concurrently. Thermal comfort mathematical indices like the Predicted Mean Vote (PMV) and the Predicted Percentage of Dissatisfied (PPD) were implemented in the software and their contours were shown to define the thermal comfort status more precisely. It was concluded that using PV systems to maintain thermal comfort conditions for a working office occupant can be very effective and an attractive solution for designers to consider in situations similar to the study.

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES