Numerical Simulation of Airflow and Airborne Pathogen Transport in Aircraft Cabins: Dynamic Mesh Analysis

By

Hassan Abdel Fattah Hassan Kotb Ali

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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Under the Supervision of

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Title of Thesis:

Numerical Simulation of Airflow and Airborne Pathogen Transport in Aircraft Cabins: Dynamic Mesh Analysis

Key Words: (must be 5 words only)
Thermal comfort; CFD; Mixing ventilation system; Dynamic mesh; Respiratory distress

Summary:
Mixing ventilation system is the current system that works in the aircraft cabins, moreover, this system needs to be improved, as the number of passengers has increased recently. In addition, transmission of respiratory infectious airborne diseases inside the aircraft cabins has always been a topic of many studies, especially cough and sneeze droplets that are induced from an infected passengers, because they have a detrimental effects on other passengers inside the cabin during flights. This work proposed three new air distribution system besides an innovative system in order to prevent transmission of cough and sneeze droplets inside the cabin using computational fluid dynamic (CFD) simulation commercial tools ANSYS FLUENT V18.1 and dynamic mesh analyses.

Disclaimer

I hereby declare that this thesis is my own original work and that no part of it has been submitted for a degree qualification at any other university or institute.

I further declare that I have appropriately acknowledged all sources used and have cited them in the references section.

Name: Date: ../../…(it's the date that you handover the thesis)

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عنوان الرسالة:

محاكاة عددية لدراسة سريان الهواء وانتقال الأمراض التنفسية المحمولة جوا داخل كبائن الطائرات: التحليل الشبكي الديناميكي

الكلمات الدالة:

توزيع الهواء– تهوية شخصية– الراحة الحرارية– التحليل الشبكي الديناميكي–كبائن الطائرات

ملخص الرسالة:

ُعد نظام دمج الهواء النظيف مع نظيره المعاد تنقيته هو نظام التهوية الموجود داخل كبائن الطائرات، ولكن يجيب أن يتم تعديل هذا النظام نظراً لزيادة عدد المسافرين في الوقت الحالي، كما يُعد انتشار الامراض التنفسية داخل كبائن الطائرات محل دراسة وبخاصة مسببات الأمراض التنفسية مثل الكحة والعطس التي تنتج من الشخص المصاب ومدى تأثيرها على باقي الركاب داخل الطائرات .من خلال هذا العمل تمت دراسة ثلاث أنظمة جديدة لتوزيع الهواء دخل كبائن الطائرات، كما تم ابتكار نظام هواء لمنع انتشار هذه المسببات داخل الكبينة. تمت هذه الدراسة بواسطة البرنامج التجاري الخاص بديناميكا الموائع الحسابية " انسيسز فلونت اصدار 18

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