**Aerospace Europe Conference 2023**
**Joint 10th EUCASS – 9th CEAS Conference**

Abstract #XXX *(to be filled by the organizers)*
Preferred Topics: HUMANF
Corresponding author: ESPOSITO Antonio
e-mail of corresponding author: Antonio.esposito@unikore.it
Type: Oral
Status of corresponding author: Regular
For student corresponding author: student member of one of the following:
3AF / AAAR / AIAE / AIDAA / CzAeS / DGLR / FTF / NVvL / PSAA / RAeS / SVFW / EUROAVIA

# Investigation of seated passengers vibration using a full-flight simulator

*Antonio ESPOSITO [1]*, Calogero Orlando [1], Andrea Alaimo [1]*

** Corresponding author*
*[1] Kore University of Enna, Cittadella Universitaria, 94100 Enna, Italy, antonio.esposito@unikore.it, calogero.orlando@unikore.it, andrea.alaimo@unikore.it.*

## Abstract
Mechanical and mathematical modeling [1] can be used for indirect and preliminary evaluation of the stresses transmitted to the human body. As far as aeronautics is concerned, it must be emphasized that pilots and crews are constantly exposed to vibrations in the environment in which they operate [2]. In this context, vibrations can profoundly affect pilots' comfort in the cockpit by altering their psychophysical state, especially in the case of long-distance flights [3]. The combination of these conditions can lead to a reduction in attention and situational awareness, affecting overall mission performance, in addition to personal health effects [4]. Given that, the seat can be considered a feature that primarily influences perceived comfort, the same stands for passengers [3].
To better understand the behavior of the human body under vibration, the measured biodynamic response data from statistical studies can be used for identifying the mechanical equivalent properties of the human body. Moreover, such data can be used for developing and validating of mathematical models. They can also be useful in the so-called human-centered perspective, which makes it possible to take into account the psycho-physiological response of the human being during the design steps.
The present work introduces a preliminary experimental campaign conducted on a sample of 20 subjects using a full flight simulator. Participants are chosen from a group of students who filled out a questionnaire on the level of perceived comfort in the cabin during actual flights. In particular, for all the selected subjects, the seat has to be considered as the primary cause of discomfort during flights. More in detail, cruise phases with two different turbulence levels are simulated and, according to Houbolt [5], these simulated flight segments can be classified as light and moderate turbulence intensity cruises. Data are collected using MEMS sensors and presented by comparing the different flight phases. Furthermore, based on the group to which the passengers belong to, the results are presented in terms of the maximum peak frequency response function evaluated between the cabin floor of the simulator and the seat signals.

## References
[1] Esposito, A., Lo Iacono, F., Orlando, C., Navarra, G., & Alaimo, A. (2022). Whole body vibration during simulated flight via uncertain models and interval analysis. Mechanics of Advanced Materials and Structures, 1-10.
[2] Zanoni, A., Cocco, A., & Masarati, P. (2020). Multibody dynamics analysis of the human upper body for rotorcraft–pilot interaction. Nonlinear dynamics, 102, 1517-1539.
[3] Vink, P. (2016). Aircraft interior comfort and design. CRC press.
[4] Smith, S. D. (2008). Dynamic characteristics and human perception of vibration aboard a military propeller aircraft. International Journal of Industrial Ergonomics, 38(9-10), 868-879.
[5] Houbolt, J. C. (1973). Atmospheric turbulence. AIAA Journal, 11(4), 421-437.