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NUMERICAL ANALYSIS OF THE IMPACT OF THE USE OF PERSONAL PROTECTIVE EQUIPMENT ON THE FACE IN THE PROCESS OF POLLUTANTS SPREADING EMITTED DURING BREATHING

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Abstract
The study presents the results of a numerical analysis of the effectiveness of the use of personal protective equipment of various designs on the spread of pollutants marked with CO_2 emitted during human breathing. In the study of 3D geometry the upper part of the human torso and head was developed. The simulated person was supplied with different personal protective equipment covering the human face (PPE). Two types of face shields worn at a different distance from the face and one fabric face mask was analysed. The reference geometry with no personal protective equipment was also analysed. Transient calculation with full breathing model including breath-in and breath-out and species transport were simulated. The results showed that different PPE generates different airflow patterns in the vicinity of the human face. The most efficient in reducing infection risk is by wearing a face mask or face shields at a small distance from the face, as they most effectively reduce CO_2 concentration in the surrounding air. However, they also increase the re-inhalation risk of high CO_2 concentration which affects human well-being.

Keywords: **CFD, human breathing, SARS-Cov-2 pandemic; infection risk; personal protective equipment.**