Numerical Simulation of Air Flow, Exhaust and Their Mixture in a Helicopter Exhaust Injective Cooler

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Abstract : Due to low-altitude and relatively low flight speed, today's combat assets like missile weapons equipped with infrared guidance systems are one of the most important threats to the helicopters performing combat missions. Especially meaningful in helicopter aviation is infrared emission by exhaust gases, regressed to the surroundings. Due to high temperature, exhaust gases are a major factor in detectability of a helicopter performing air combat operations. This study presents the results of simulating the flow of the mixture of exhaust and air in the flow duct of an injective exhaust cooler, adapted to cooperate with the PZL 10W turbine engine. The simulation was performed using a numerical model and the ANSYS Fluent software. Simulation computations were conducted for set flight conditions of the PZL W-3 Falcon helicopter. The conclusions resulting from the conducted numerical computations should allow for optimisation of the flow duct geometry in the cooler, in order to achieve the greatest possible temperature reduction of exhaust exiting into the surroundings. It is expected that the obtained results should be useful for further works related to the development of the final version of exhaust cooler for the PZL W-3 Falcon helicopter.

Keywords : exhaust cooler, helicopter, numerical simulation, stealth

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