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Helicopter Exhaust Gases Cooler in Terms of Computational Fluid Dynamics (CFD) Analysis

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Abstract : Due to the low-altitude and relatively low-speed flight, helicopters are easy targets for actual combat assets e.g. infrared-guided missiles. Current techniques aim to increase the combat effectiveness of the military helicopters. Protection of the helicopter in flight from early detection, tracking and finally destruction can be realized in many ways. One of them is cooling hot exhaust gasses, emitting from the engines to the atmosphere in special heat exchangers. Nowadays, this process is realized in ejective coolers, where strong heat and momentum exchange between hot exhaust gases and cold air ejected from atmosphere takes place. Flow effects of air, exhaust gases; mixture of those two and the heat transfer between cold air and hot exhaust gases are given by differential equations of: Mass transportation–flow continuity, ejection of cold air through expanding exhaust gasses, conservation of momentum, energy and physical relationship equations. Calculation of those processes in ejective cooler by means of classic mathematical analysis is extremely hard or even impossible. Because of this, it is necessary to apply the numeric approach with modern, numeric computer programs. The paper discussed the general usability of the Computational Fluid Dynamics (CFD) in a process of projecting the ejective exhaust gases cooler cooperating with helicopter turbine engine. In this work, the CFD calculations have been performed for ejective-based cooler cooperating with the PA W3 helicopter's engines.

Keywords : aviation, CFD analysis, ejective-cooler, helicopter techniques
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