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Numerical Studies on Bypass Thrust Augmentation Using Convective Heat Transfer in Turbofan Engine

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Abstract : The turbofan engine is a type of air breathing engine that is widely used in aircraft propulsion produces thrust mainly from the mass-flow of air bypassing the engine core. The present research has developed an effective method numerically by increasing the thrust generated from the bypass air. This thrust increase is brought about by heating the walls of the bypass valve from the combustion chamber using convective heat transfer method. It is achieved computationally by the use external heat to enhance the velocity of bypass air of turbofan engines. The bypass valves are either heated externally using multicell tube resistor which convert electricity generated by dynamos into heat or heat is transferred from the combustion chamber. This increases the temperature of the flow in the valves and thereby increase the velocity of the flow that enters the nozzle of the engine. As a result, mass-flow of air passing the core engine for producing more thrust can be significantly reduced thereby saving considerable amount of Jet fuel. Numerical analysis has been carried out on a scaled down version of a typical turbofan bypass valve, where the valve wall temperature has been increased to 700 Kelvin. It is observed from the analysis that, the exit velocity contributing to thrust has significantly increased by 10 % due to the heating of by-pass valve. The degree of optimum increase in the temperature, and the corresponding effect in the increase of jet velocity is calculated to determine the operating temperature range for efficient increase in velocity. The technique used in the research increases the thrust by using heated by-pass air without extracting much work from the fuel and thus improve the efficiency of existing turbofan engines. Dimensional analysis has been carried to prove the accuracy of the results obtained numerically.

Keywords : turbofan engine, bypass valve, multi-cell tube, convective heat transfer, thrust
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