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Newly proposed multi stream turbofan engine with built in regenerative heat exchanger

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Present cores of modern turbofan engines faces some problems, such as, very expensive components, high maintenance costs, Its blades are exposed to erosion or corrosion due to the very high TIT or debris. Its blades can easily be heavily damaged by any bird strike, also these cores are exposed to any air disturbances or differences in air mass flow rate due to changes in flight levels and also excessively high fuel consumption rates. Because air enters from the atmosphere through the intake, compressed is combusted inside the combustion chamber, then combustion products get out from the nozzle after expanding into the turbines. So anything can easily enter inside the core to destroy or at least affect the core components efficiency such as (dust, sand, ice, rain or birds). So these cores must contain compressor and turbine blades made of very expensive materials to be able to resist erosion, corrosion, debris and high temperature, but at the end, it becomes less and less efficient with use. Also, these cores can be more fuel economy whenever bypass ratio is bigger. Multi-stream turbofan engine has resolved all these problems using closed core system (which mean that no air inters in engine core and no air out from engines core). This engine looks like the present modern turbofan engines structure in everything except air stream inside the core, combustion chamber position and the two built-in heat exchangers. Built-in heat exchangers have no previous applications in aero engines, but multi-stream turbofan engine is designed with two built-in heat exchangers. One for heating Core air before entering into turbines and the other one is to cool Core air down before entering into the compressor. That will led to raise compressor's and turbine's efficiency and will reduce fuel consumption rates. This system (closed Core System) will solve erosion and corrosion and there will be no need for turbine blades made of very special and costly materials to withstand all conventional engine problems. It will be safer from bird strikes, any air disturbance will have no significant effect on core performance due to the closed independent core and especially at very high bypass ratio up to 40:1 that will help to achieve lower rate of fuel consumption than the conventional engines. Multi-stream turbofan engine has achieved static thrust up to 340KN, bypass ratio up to 40:1 and can save up to 70% from takeoff and trip fuel.

Biography

Essam Eldin Khalil did BSc (1971) with honors and MSc (1973) Mechanical Engineering, Cairo University and PhD (1977) from Imperial College of Science and Technology, London University, UK. Currently, Professor of Mechanical Engineering, Cairo University since June 1988. Over 45 years of experience in Design and simulation of combustion chambers and furnaces for terrestrial and aerospace application. Had published over 728 articles, conference papers and journal papers on the subjects of Combustion Chamber Design, energy and indoor air quality within AIAA conferences, ASME and ASHRAE publications. Such activities were also disseminated through more than 190 presentations worldwide and 60 articles. Developed advances courses in air conditioning, heat transfer, gas turbine combustors and terrestrial energy-related areas and ABET program evaluator.

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