Multiparametric numerical investigation of a synthetic jet generator for active flow control in transition channels

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The paper focuses on the numerical investigation of the influence of synthetic jet generator units on the flow in transition channels. The study was carried out by RANS and URANS methods. Synthetic jets of zero gas-weight flotation provide a promising active flow control means. By using them, it is possible to reduce or eliminate the flow separation in transition channels improving the characteristics of the aircraft power plant as a whole. The calculations were performed with complete simulation of the synthetic jet generation process in transition channels. Gas-dynamic processes in the cavity of synthetic jet generators are described. The technique for calculating the flow and estimating losses in diffuser channels has been worked out using synthetic jet generator units. As a result, a good coincidence of the calculated and experimental data in the model ring channel was obtained without using active control means, which made it possible to apply this technique to solve other similar problems. Multiparametric numerical investigation was done in a flat model channel in order to determine the best location options and characteristics of synthetic jet generators. We also calculated a segment of the full-scale "aggressive" channel and found that its length was less than the standard one. The calculation was done between high and low pressure turbines of a modern turbojet engine using synthetic jet generator units directed at an angle of 45° to the flow, since a decrease in the total pressure loss for this type of units in the model channel appeared significant. Results suggest that the use of synthetic jet generator units with the necessary amplitude of speed and frequency of oscillations, and with the optimal location in the channel, will improve the characteristics of the engine as a whole due to the complete or partial elimination of the separation zone in the transition channel.

Keywords: *active control, RANS and URANS methods, synthetic jets, transition channel, aggressive channel, annular channel*

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