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Aerodynamic characteristic improvement of a slot-less flap air foil by pulse blowing

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Application of active flow control on aircraft has been the subject of research and development for many years. Only the energy input is small enough and the aerodynamic performance gains a lot, the technology of flow control can be widely used in the commercial aircraft. Compared to the steady blowing, the energy of the pulse blowing is smaller and the control effect is more efficient, so it is used more and more in the aircraft aerodynamic characteristic improvement. The effect of pulse frequency, duty cycle and moment coefficient on aerodynamic characteristics of a slot-less flap air foil is studied by numerical simulation. The results show that the optimal pulse frequency for the lift increment approximately equals the vortex shedding frequency, the drag increases when the pulse frequency is lower than the vortex shedding frequency and the optimal pulse frequency for the drag reduction is about twice the optimal lift increment frequency. The lift increases with reducing duty cycle at relatively low moment coefficient due to the impact effect. When the moment coefficient is lower than the critical moment coefficient, the pulse blowing is more sufficient to improve lift performance, while the moment coefficient is higher than the critical moment coefficient; the steady blowing is the best choice.

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