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1 **Numerical investigation of drag and heat flux reduction mechanism**
2 **of the pulsed counterflowing jet on a blunt body in supersonic flows**

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9 **Abstract:** To design a kind of aerospace vehicle, the drag and heat flux reduction are the most
10 important factors. In the current study, the counterflowing jet, one of the effective drag and heat
11 flux reduction concepts, is investigated numerically by the two-dimensional axisymmetric
12 Reynolds-averaged Navier-Stokes equations coupled with the SST $k-\omega$ turbulence model. An
13 axisymmetric numerical simulation mode of the counterflowing jet on the supersonic vehicle
14 nose-tip is established, and the numerical method employed is validated by the experimental
15 schlieren images and experimental data in the open literature. A pulsed counterflowing jet scheme
16 is proposed, and it uses a sinusoidal function to control the total and static pressures of the
17 counterflowing jet. The obtained results show that the long penetration mode does not exist in the
18 whole turnaround, even in a relatively small range of the jet total and static pressures, and this is
19 different from the phenomenon obtained under the steady condition in the open literature. At the
20 same time, it is observed that the variation of the physical parameters, such as the Stanton number
21 induced by the pulsed jet, has an obvious periodicity and hysteresis phenomenon.

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