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Parametric study on the drag and heat flux reduction mechanism of forward-facing cavity on a blunt body in supersonic flows

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1 **Parametric study on the drag and heat flux reduction mechanism of**
2 **forward-facing cavity on a blunt body in supersonic flows**

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7 **Abstract:** Drag and heat flux reduction is very important for the design of the hypersonic vehicle,
8 and many novel strategies have been proposed recently. As one of the valid drag and heat flux
9 reduction schemes, the forward-facing cavity has attracted an increasing attention for the scholars.
10 In the current study, the influence of the cavity configuration on the drag and heat flux reduction
11 mechanism of a blunt body has been investigated numerically by the two-dimensional
12 axisymmetric Reynolds-averaged Navier-Stokes (RANS) equations coupled with the SST k- ω
13 turbulence model, and the effects of the depth of the cavity and the angle of its trailing edge have
14 been taken into consideration. At the same time, the numerical approaches employed in this paper
15 have been validated against the available experimental data in the open literature, as well as the
16 grid independency analysis. The obtained results shows that the cavity configuration has only a
17 slight impact on the drag reduction of the blunt body in the supersonic flow with the freestream
18 Mach number being 3.98, and the maximum drag reduction coefficient is within 1.0%. The
19 forward-facing cavity with $L/D=4.0$ and $\theta=45^\circ$ is the most beneficial configuration for the heat
20 flux reduction of the blunt body in the range considered in the current study, and it should be
21 validated by the wind tunnel test in the near future.

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