High Pressure Zone Capture Wing Configuration for High Speed Air Vehicles

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To aim at design requirements of large capacity, high lift, low drag, and high lift-to-drag ratio for high speed air vehicles, a new aerodynamic configuration concept, named high pressure zone capture wing (HCW) configuration is firstly proposed in this paper. By comparison with traditional lift body or waverider configurations, the new feature of the HCW configuration is to introduce a surface wing, which is upon the airframe of the vehicle and paralleled with the free stream. In high speed cruising conditions, the HCW can capture the high pressure zone compressed by the upper surface of the vehicle. Thus the lift of the vehicle can get a considerable compensation due to the large pressure difference between the upper and the lower surface of the HCW. The lift-to drag ratio can also obtain a large improvement as a result. Besides, the increase of the volume and the weight of the vehicle will lead to higher lift of the HCW. Therefore, a self-compensation effect between the lift and the weight of the vehicle is achieved. Several conceptual configurations with different airframes and HCWs are designed as well as their aerodynamic performance are evaluated by computational fluid dynamics as examples. The results clearly demonstrate the high aerodynamic performance of the HCW configuration. In almost all cases, the lift of the HCW configuration increases by more than 30 percent compared with the configuration without the HCW while the lift-to-drag ratio increases by 20 percent above.

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