TOWARDS SUBSTANTIAL DRAG REDUCTION FOR TRANSONIC WINGS USING AERODYNAMIC OPTIMISATION WITH SHOCK CONTROL THROUGH REDUCED WING SWEEP

Ning Qin

Department of Mechanical Engineering, University of Sheffield
Sheffield S1 3JD, South Yorkshire, United Kingdom

ABSTRACT

With the development of aerodynamic optimisation and shock control, significant drag reduction has been achieved using shock control bumps at high transonic speeds. The research has moved into more robust designs, such as three dimensional bumps, to enlarge the operational range of the shock control devices. Robust shock control, in turn, unlocks a number of key limiting factors in transonic wing design for further drag reduction. A key limiting factor in transonic wing design is the required wing sweep to alleviate the transonic shock waves. With the shock wave under control, the wing sweep angle can be reduced significantly without the penalty of increased wave drag and the associated shock induced separation. Reduced wing sweep results in two major benefits; (1) the possibility to revisit the natural laminar flow wing design for large skin friction drag reduction and (2) the associated wing structural weight reduction with reduced sweep. This presentation will discuss work on shock control design optimisation on laminar flow aerofoils and wings and its implication in substantial wing drag reduction through reducing wing sweep.