A method for rapidly estimating the aeroheating, shear stress, and other properties of hypersonic flow about a three-dimensional (3D) blunt body has been devised. First, the geometry of the body is specified in Cartesian coordinates. The surface of the body is then described by its derivatives, coordinates, and principal curvatures. Next, previously relatively simple equations are used to find, for each desired combination of angle of attack and meridional angle, a scaling factor and the shape of an equivalent axisymmetric body. These factors and equivalent shapes are entered as inputs into a previously developed computer program that solves the two-dimensional (2D) equations of flow in a non-equilibrium viscous shock layer (VSL) about an axisymmetric body. The coordinates in the output of the VSL code are transformed back to the Cartesian coordinates of the 3D body, so that computed flow quantities can be registered with locations in the 3D flow field of interest. In tests in which the 3D bodies were elliptic paraboloids, the estimates obtained by use of this method were found to agree well with solutions of 3D, finite-rate-chemistry, thin-VSL equations for a catalytic body.

This work was done by Carl D. Scott and Irina G. Brykina of Johnson Space Center. For further information, contact the Johnson Innovative Partnerships Office at (281) 483-3809. MSC-23126