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Author: Mr. Jiatong Shi
China Academy of Aerospace Aerodynamics (CAAA), China, shijiatong56@sina.com

Mr. Deng Daiying
China, ddywork@163.com
Mr. xuejun zhang
China Academy of Aerospace Aerodynamics (CAAA), China, hmskdyy@tom.com
Prof.Dr. Ai Bangcheng
China Academy of Aerospace Aerodynamics (CAAA), China, stara@sohu.com

# COUPLING NUMERICAL METHOD RESEARCH OF THERMAL ENVIRONMENT/ABLATION FOR 3-DIMENSIONAL HYPERSONIC SPHERECONE

**Abstract**

A loose coupling numerical simulation of aerothermal heating and the material ablation was present. The flow field was conducted by the 3-dimensional Navier-Stokes equations. For a given shape, structured grid was generated automatically in Gridgen's Tcl langrage. Through the method of computational fluid dynamics (CFD), obtaining high accuracy results contains heat flux and pressure, which were provided to ablation calculating. The ablation procedure considered correlation calculation method based on theory of thermochemical ablation, which was used to solving ablation rate and recession amount of each wall surface grid point. Then a new shape was got for the coupling calculation of next step. The coupling method was applied to a sphere-cone, with length was 150mm, radius was 30mm, and half cone angle was 10 degrees. The simulation time was 100s and the time step was 1s. The original Mach number was 30, at an altitude of 60km and angle of attack 30 degrees. The final Mach number was 5, at an altitude of 20km and angle of attach 0. The inside conditions were got by linear interpolation method. Along an assumed trajectory, heat flux, pressure, temperature, velocity of recession and distance of recession were in monitored. Analysis of the above variables indicated that the coupling calculation was reasonable. Therefore, the loose coupling approach may be useful for fast prediction of ablation in engineering.