PRELIMINARY APPLICATION OF FOCUSING SCHLIEREN IN THE MEASUREMENT OF INLET SHOCK WAVE/BOUNDARY LAYER

XIE Aimin[1] WANG Zhenfeng[1,2] JIANG Tao[1] HUANG Jie[1]

(1. Hypervelocity Aerodynamics Institute of CARDC, Mianyang, Sichuan 621000, China;
2. Science and Technology on Scramjet Laboratory, Hypervelocity Aerodynamics Institute of CARDC,

Mianyang Sichuan 621000, China)

Abstract: Shock wave/boundary layer interaction (SWBLI) on hypersonic inlet external compression surface has remarkably influence on the inlet performance, and the characteristic of SWBLI on the forebody of aircraft is influenced by the radius of forebody leading edge. In order to get the development and wave structure variety rule of the boundary layer influence by the radius of forebody leading edge in the shock wind tunnel, the focusing schlieren technique has been used to show the flow filed of inlet external compression surface.

Fig.1 is the sketch map of focusing system, the field diameter of the system in the testing center is 150mm, its sharp focus depth is about 4mm, and unsharp focus depth is about 40mm, the technique has the characteristic of focusing, the flow information gotten by the technique mainly reflect a certain flow region, so it can well show the boundary layer. Fig.2 is the focusing schlieren image at the condition that the income flow Mach number is 5.98, the total temperature is 670K, and the total pressure is 6.557MPa. According to the focusing schlieren images, when the forebody blunt degree is changed, the thickness distribution of boundary layer will be much changed and the wave structure will be changed obviously also. This paper also calculates the boundary layer change rules through CFD, and the contrast results with the measurement value are satisfied.

Key words: Focusing schlieren, Hypersonic inlet, External compression surface, Shock Wave/Boundary Layer Interaction, Radius of forebody leading edge

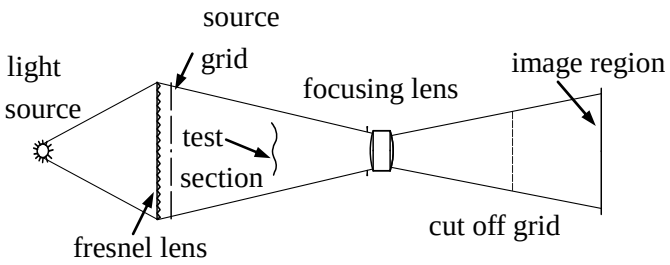

Fig.1 Optical diagram of focusing schlieren

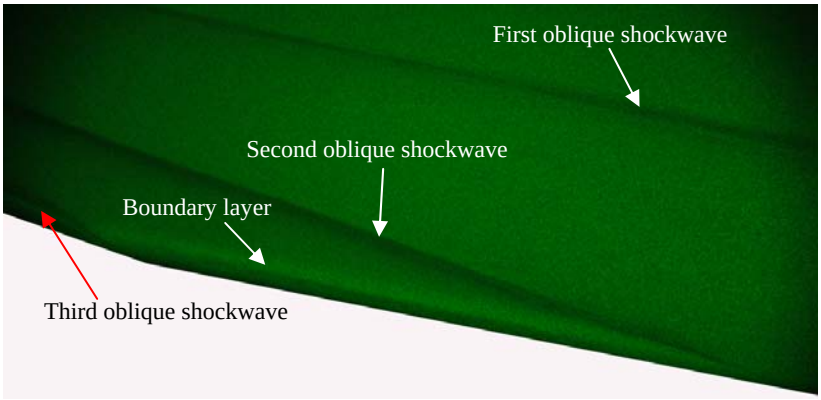

Fig.2 Focusing schilieren image and the radius of forebody leading edge is 1mm