Paper ID: 92355
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Ground-Based Preparatory Activities (13)
Ground-Based Preparatory Activities - IP Session (IP)

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AERODYNAMIC AND STRUCTURAL OVERALL DESIGN OF PRESSURE REGULATING VALVE IN LARGE ANGLE DIFFUSION SECTION OF TEMPORARY IMPULSE TRI-SONIC WIND TUNNEL

Abstract

In the temporary impulse tri-sonic wind tunnel, the pressure regulating valve is used to control the stability of the front chamber pressure of the wind tunnel and finally obtain a stable test Mach number. The performance of the pressure regulating valve will directly affect the speed of establishing the wind tunnel flow field, the accuracy of Mach number regulation, and the operational efficiency of the wind tunnel. It is a critical equipment of the wind tunnel. Different from the traditional layout of "equal straight section annular slot pressure regulating valve + 2 layer porous plate large angle diffusion section" pressure regulating valve in the temporary impulse wind tunnel, this paper takes the integrated design and optimization of the large angle diffusion section pressure regulating valve in the large temporary impulse tri-sonic wind tunnel as the research object, and studies its unique pressure regulating characteristics and aerodynamic noise performance in the wind tunnel. According to the characteristics of the wind tunnel, a large angle diffusion section annular pressure regulating valve is selected to adapt to its wide range of working parameter adjustment, high adjustment accuracy, and low operating resistance. The overall design and optimization of the pressure regulating valve were carried out, including aerodynamic and structural design, pressure regulating characteristic analysis, kinematic analysis, flow field analysis, vibration analysis and structural optimization, aerodynamic noise simulation and design of post valve sintering wire mesh noise reduction scheme, and measurement and control system design. Based on aerodynamic design and performance requirements, some important components have been designed and selected. Through CFD numerical simulation, the pressure regulating characteristics and noise characteristics of the pressure regulating valve were discussed, and the influencing factors of irregular flow were analyzed and evaluated. The regulator that achieves linear or approximately linear regulation characteristics has been ultimately determined The overall plan.