

Study on Accurate Calculation Method of Model Attitude on Wind Tunnel Test

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Abstract : The accurate of model attitude angel plays an important role on the aerodynamic test results in the wind tunnel test. The original method applies the spherical coordinate system transformation to obtain attitude angel calculation. The model attitude angel is obtained by coordinate transformation and spherical surface mapping applying the nominal attitude angel (the balance attitude angel in the wind tunnel coordinate system) indicated by the mechanism. First, the coordinate transformation of this method is not only complex but also difficult to establish the transformed relationship between the space coordinate systems especially after many steps of coordinate transformation, moreover it cannot realize the iterative calculation of the interference relationship between attitude angels; Second, during the calculate process to solve the problem the arc is approximately used to replace the straight line, the angel for the tangent value, and the inverse trigonometric function is applied. Therefore, in the calculation of attitude angel, the process is complex and inaccurate, which can be solved approximately when calculating small attack angel. However, with the advancing development of modern aerodynamic unsteady research, the aircraft tends to develop high or super large attack angel and unsteady research field. According to engineering practice and vector theory, the concept of vector angel coordinate system is proposed for the first time, and the vector angel coordinate system of attitude angel is established. With the iterative correction calculation and avoiding the problem of approximate and inverse trigonometric function solution, the model attitude calculation process is carried out in detail, which validates that the calculation accuracy and accuracy of model attitude angels are improved. Based on engineering and theoretical methods, a vector angel coordinate system is established for the first time, which gives the transformation and angel definition relations between different flight attitude coordinate systems, that can accurately calculate the attitude angel of the corresponding coordinate system and determine its direction, especially in the channel coupling calculation, the calculation of the attitude angel between the coordinate systems is only related to the angel, and has nothing to do with the change order s of the coordinate system, which simplifies the calculation process.

Keywords : attitude angel, angel vector coordinate system, iterative calculation, spherical coordinate system, wind tunnel test

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