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Research Article

Wind Tunnel Test Study on Separation Characteristics of Parallel Stages

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ABSTRACT

Established a supersonic and hypersonic wind tunnel free-flying test technique for separation between parallel stages, solved the problem of separation and unlocking of the free two-stage model of the assembly, and ensured that the relative position and attitude were fixed, when the model is separated. It is fast and effective without interference, and it can simulate the initial separation distance and the separation attitude angle of two models; it solves the problems of dual-optical path illumination and image acquisition technology. And solve the problem of six-degree-of-freedom attitude image recognition technology in two models. Two experimental models are designed by using the light model method and the more feasible and heavier model design method. The results of the two models are compared and analyzed, and the influence of the different model design methods on the test results is obtained. The specific effects of different initial conditions on the separation characteristics were investigated, and concrete conclusions were drawn.

Keywords: Wind tunnel; Hypersonic; Scaffold model.

INTRODUCTION

Model wind tunnel tests

Wind stream tests ought to be completed when wind loads are huge for by and large security, counterbalance, movement, or basic reaction, or there is the threat of dynamic shakiness. Air stream tests may bolster or supplant hypothetical counts when accessible hypothetical techniques are vulnerable to enormous vulnerabilities (e.g., because of another sort of establishment or a contiguous establishment that impacts the pertinent establishment).

Information got from dependable and satisfactory model tests are suggested for the assurance of weights and coming about burdens on structures of complex shape.

Tests ought to be completed on an appropriately scaled model of the full scale state of the structure. The genuine breeze ought to be displayed to represent the variety of the mean breeze speed with tallness over the ground or seawater, and the disturbance level in the breeze.

Wind tunnel test and CFD

Air stream tests have been broadly used to foresee the breeze initiated reactions of extensions, just as to gauge wind stacking. Since the extension model scale is a lot littler than the genuine scaffold, it is hard to fulfill the Reynolds number likeness, so it is normally ignored, in light of the way that the stream example may not change fundamentally with the diverse Reynolds numbers if the extension and its individuals comprise of sharp edges. Yet, consideration must be paid to a structure with bended surface or corner cuts on the grounds that in such cases, the Reynolds number may change the streamlined qualities fundamentally. Point by point conversations about the likeness and demonstrating, and methods for air stream trial of scaffolds are given [1,2].

It is critical to take note of that only a little contrast in the scaffold deck cross-sectional shape, for example, adjustment of the railings, may change the breeze prompted reaction of the extension enormously. Since it is important to have a huge model scale to replicate the geometric detail and the extension reaction to wind is overwhelmingly influenced by the reaction attributes of the scaffold deck, an area model of the scaffold deck is regularly used to check for obstruction against dynamic reactions. This model is upheld with springs so it speaks to a predominant reaction method of the full scaffold. The full scaffold model test is likewise led if the three-dimensional (3D) impacts along the range can't be dismissed or the breeze impacts are huge to such an extent that an intensive examination is fundamental.

Computational liquid elements (CFD) is a device to decide the stream utilizing PCs. Due to the fast development of figuring limit and the advancement of effective calculation plans, CFD has gotten well known in numerous fields of liquid elements [3]. In any case, the different streams around a structure are muddled, and for the most part it is hard to get a quantitative expectation of

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the streamlined power and reaction utilizing CFD [4]. To conquer this issue, broad examinations have been and are at present being performed on using CFD in the field of scaffold optimal design. For example, a smooth out box brace was examined utilizing an expound numerical model where even railings were imitated, and the got consistent and temperamental streamlined coefficients concurred well with trial results. In another model, a numerically less requesting model was utilized to get the coefficients which additionally concurred sensibly well with test results. Despite the fact that it might be as yet hard to utilize CFD for the last estimation of the scaffold reaction to wind, the outcomes by CFD are as of now utilized at the principal phase of wind-safe plan where the general cross-sectional state of a deck is picked.

DISCUSSION AND CONCLUSION

The main difficulty of the free flight test in parallel stage separation wind tunnel is different from that in the existing wind tunnel free flight test technology: first, the two-stage model as a whole enters the flow field as a rigid body and is completely free, and it is necessary to unlock and release the six degrees of freedom between the first stage and the second stage models at a designated position. How to effectively unlock is a key problem. Secondly, the quality of the two-stage model is close, which will lead to the whole model center of mass located near the interface of the first stage and the second stage or even the gap between the two. If the pull pin force is not enough, it will inevitably lead to the rolling motion of the whole model and the test distortion. How to design the reliable pull pin mechanism at the two-stage gap has become another big problem in this study. In addition, the free flight test needs to use high-speed photography to shoot the moving image of the model. In this study, there must be a serious overlap between the first level and the second level model, which increases the difficulty of image identification.

REFERENCES

1. Siringoringo DM, Fujino Y. Observed along-wind vibration of a suspension bridge tower. J Wind Eng Ind Aerod. 1992;103:107-121.
2. Fujitsuna Y, Tanaka A. A conceptual study for future engine test facility. AIAA. Aerospace Ground Testing Conference, 17th, Nashville, Tennessee, USA. 1992;11:6-8.
3. Pan Y, Zhang Y, Sarwar G. Impact of gas-phase chemistry on wrf/chem predictions of o3 and pm2.5: mechanism implementation and comparative evaluation. Presented at the 7th Annual CMAS Conference, Chapel Hill, North Carolina'. USA. 2008.
4. Nieto S. The light in their eyes: Creating multicultural learning communities. Teachers College Press, USA, 2015.