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An Optimized Dynamical Design of Aircraft Belly Shell

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Modifications on the aircraft structure are often required for special equipments used for, such as search & rescue, meterological monitoring and fire control. One common case is a protection shell under the aircraft's belly. We hereby propose a structure design in this kind for one kind of Cessna aircraft. The modification may incur an obvious detached vortex under aircraft belly during flight, imposing negative influences.

To achieve the modification optimization, one three-dimensional model as same size as the aircraft with and without shell is established by CATIA. The air flow field model featured by three sizes in 1:5, 1:8, and 1:10 scale is constructed. Hexahedron mesh and tetrahedron mesh generation are integrated to accomplish by ICEM with O-block method. We use FLUENT to test the aircraft in flight, calculate and compare aerodynamic changes for aircraft model with the shell. Then, the traditional model, which uses guide neoprene seal behind shell to diminish the effects of detached vortex, is compared with a novel proposed model, which uses winglets behind shell to achieve an optimized aerodynamic structure. The research presents strong support for shell modification.

REFERENCES

[1] Chao Yan(2006). Computational fluid dynamics methods and application. Beihang University Press.

[2] Ji Shen, Jihuai Lv(1999). Study on Design Method of Aircraft Radome. *Journal of Nanjing University of Aeronautics & Astronautics* **31(5)**:594-598.

[3] Leibreck R. H(2004). Design of the blended wing body subsonic transport. *Journal of Aircraft* **41(I):**10-25.

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