Simulation of Gravity Feed Oil for Areoplane Fuel Transfer System

Y. G. Lv^{1,*}, Z. X. Liu¹, S. Q. Huang¹, T. Xu²

¹ College of Power and Energy, Northwestern Polytechnical University, Xi'an 710072, China

² Military Representatives office of NDMMP, Xi'an 710025, China

Email: lyg07391@163.com

Abstract

Generally, it has two different ways for fuel transfer for areoplane, the simplest one is by gravity, and another is by pumps. But the simplest one might change to the vital method in some situation, such as electrical and mechanical accident. So the study of gravity feed oil is aslo important. Past calculations assumed that, under gravity feed, only one fuel tank in aircraft supplies the fuel needed for preventing extremely serious accident to happen. Actually, gravity feed oil is a transient process, all fuel tanks compete for supplying oil and there must have several fuel tanks offering oil simultaneously. The key problems to calculate gravity feed oil are the sumulation of the multiple-branch and transient process. Firstly, we presented mathematical models for oil flow through pipes, non-working pupms and check valves, ect. Secondly, On the basis of flow network theory and time difference method, we established a new calculation method for gravity feed oil of aeroplane fuel system. This model can solve the multiple-branch and transient process simulation of gravity feed oil. Our method takes into consideration all fuel tanks and therefore, we believe, our method is intrinsically superior to traditional methods and is closer to understanding the real seriousness of the oil supply situation. Finally, we give a numerical example using the new method for a certain type of aircraft under gravity feed . achieved the variations of oil level and flow mass per second of each oil tanks which showed in Figures below. These variations show preliminarily that our proposed method of calculations is satisfactory.

Figure 1: Variation of oil level in each fuel tank

Figure 2: Variation of flow mass of each fuel tank

REFERENCES

1. Wu D Y. Network Algorithm of Internal Flow System. *Journal of Aerospace Power*, 1997; **17**(6): 653-657
2. Chun S M. Network Analysis of An Engine Lubrication System. *Tribology International*, 2003; **36**(8): 609-617
3. Streeter V L, Wylie E B, Bedford K W. *Fluid Mechanics*. McGraw-Hill Companies, Inc. 1998