Dataset and Analysis of Bow Wave Effect Based on Fluent

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Introduction

This is a file set which is used to analyze the bow wave effect. The bow wave effect is an important disturbance in the probe-and-drogue refueling. Thus, a series of data are generated by using Fluent, and recorded in the dataset (Excel files).The drogue and the fore body of the receiver are taken into consideration simultaneously. The graphic files used in Fluent and a Fluent case are included in the file set. It also includes two Matlab files which are used to analyze the data.

File List

Gambitfiles (The Gambit 3D models of the receiver and the drogue):

geometry.dbs, geometry.jou, geometry.trn

Fluent files (A Fluent case):

F16x02_25y0_00z0_00.cas

Excel files (All the Fluent data are recorded in these):

z=0.xlsx, y=0.xlsx, y=0.3.xlsx

Matlab files (Use these files to get the profiles and optimize the parameters):

Nonlinefit_BW.m, Profiles_BW.m

Usage

1. Use Gambit (the version we used is 2.4.6) to open the Gambit files. The relative position between the receiver and the drogue can be changed by Gambit, and the interface of Gambit is as Fig. 1 shown.

2. Use Fluent (the version we used is 6.3.26) to set the simulation environment, and generate a mesh. Because the all of the simulation data are too large, so we just choose one of them as an example: the file, F16x02_25y0_00z0_00.cas, is the case under $x = 2.25, y = 0, z = 0$. The point (x, y, z) is in the CFD frame ($o_f - x_f y_f z_f$, as Fig. 2 shown) which is mentioned in Reference [1].i) Open the case file by using 3D version of Fluent. ii) Initialize it at velocity value is $[120, 0, 0]^{\mathrm{T}}$ m/s. iii) Iterate.iv) Report the force information of drogue in x, y, z directions respectively. Fig. 3 is the contours of velocity magnitude of the case.

3. The training data, which are obtained by Fluent, are recorded in the three Excel files. The six columns of them mean $x_d, y_d, z_d, f_{bx}, f_{by}, f_{bz}$ in order, which are explained in Reference [1]. Here, $\boldsymbol{p}_d = [x_d, y_d, z_d]^{\mathrm{T}}$ is the position of the drogue which is the input of the data, and the bow wave force acting on the drogue is expressed by $\boldsymbol{f}_b = [f_{bx}, f_{by}, f_{bz}]^{\mathrm{T}}$, which is the output of the data, as Fig. 4 shown.[1]

4. Put the Matlab files and the three Excel files in the same folder. By using Matlab (the version we used is 2013a) to run Profiles_BW.m, three profiles can be obtained as examples, and the results are as Fig. 5 shown.

5. Put the Matlab files and the three Excel files in the same folder. By using Matlab(the version we used is 2013a) to run Nonlinefit_BW.m, the parameters of Eq. (19) of Reference [1] can be optimized.

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[1]Since the z-axis in Fluent points to the sky in the opposite direction of $o_f - x_f y_f z_f$, the z-axis data need to be reversed to fit $o_f - x_f y_f z_f$.

If you have any questions, then please feel free to contact Zi-Bo Wei (whisper@buaa.edu.cn) or QuanQuan (qq_buaa@buaa.edu.cn). If you use these data in your paper, please cite it as: Zi-Bo Wei, Xunhua Dai, QuanQuan, Kai-Yuan Cai, “Dataset and Analysis of Bow Wave Effect Based on Fluent”, http://rfly.buaa.edu.cn/, August, 2015.

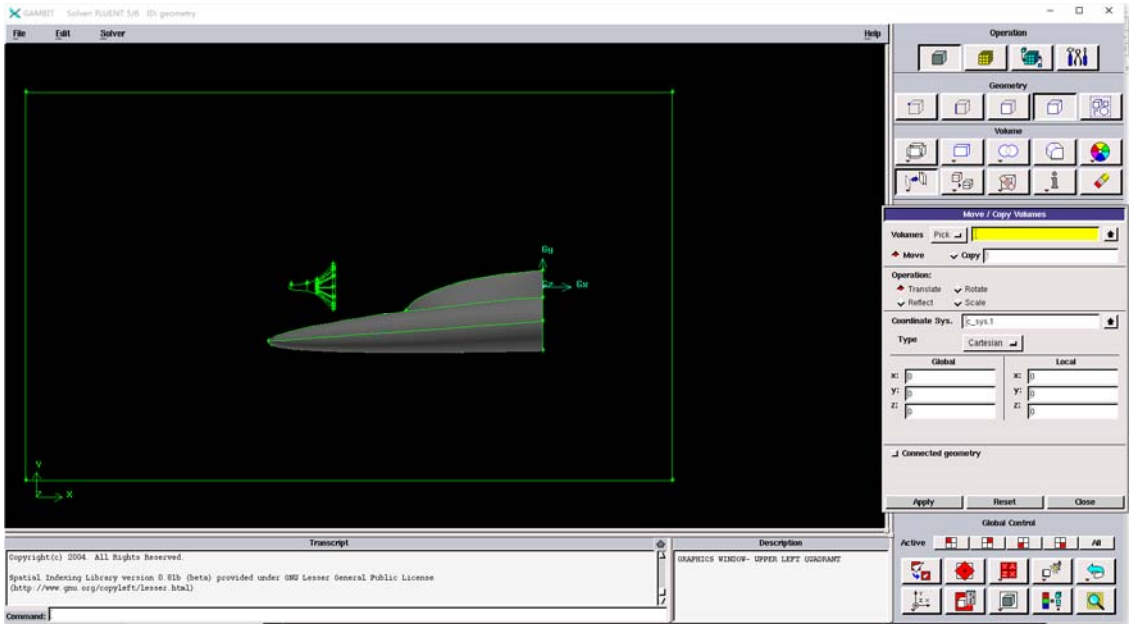

Fig.1 The 3D-model of the drogue and the receiver in Gambit

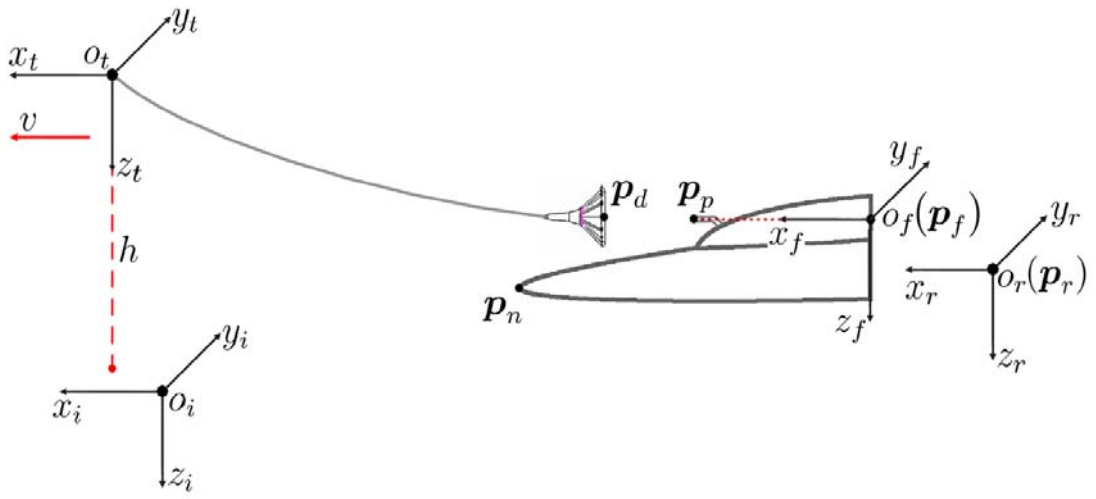

Fig. 2 The frame used in Reference [1]

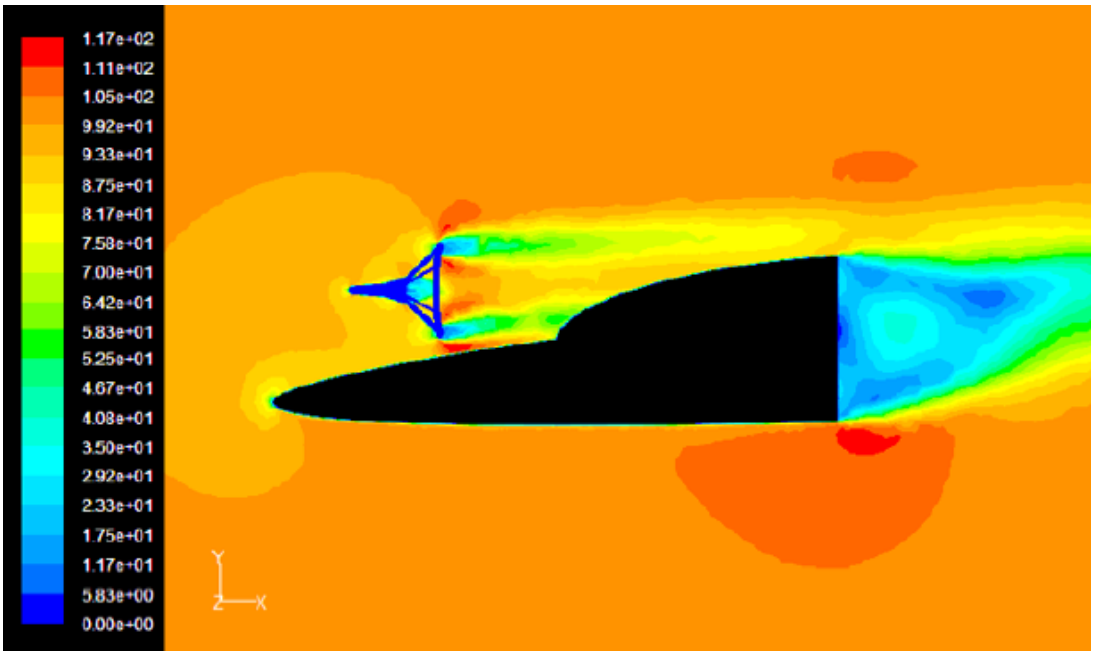

Fig.3 A contours of velocity magnitude obtained by using a fluent case

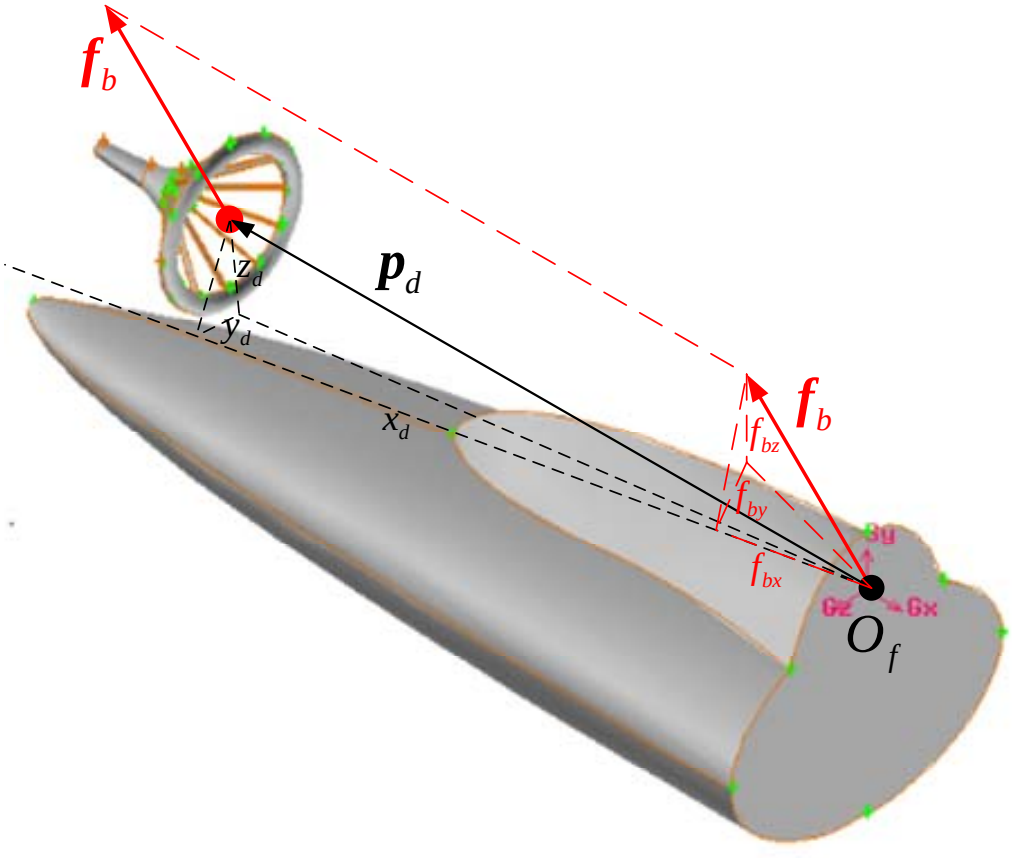

Fig. 4 The position of the drogue ($\boldsymbol{p}_d$) and the bow wave force acting on the drogue ($\boldsymbol{f}_b$)

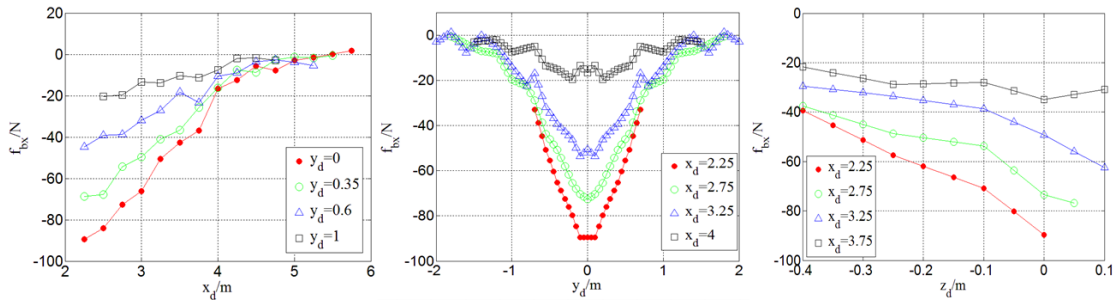

Fig. 5 Three profiles obtained by using Profiles_BW.m

Reference

[1]Zi-Bo Wei, Xunhua Dai, Quan Quan, Kai-Yuan Cai, Drogue Dynamic Model under Bow Wave in Probe-and-drogue Refueling.