AME 30341: Aerospace Structures
Homework 10

Tyler Duffy, 901904752
8 December 2016
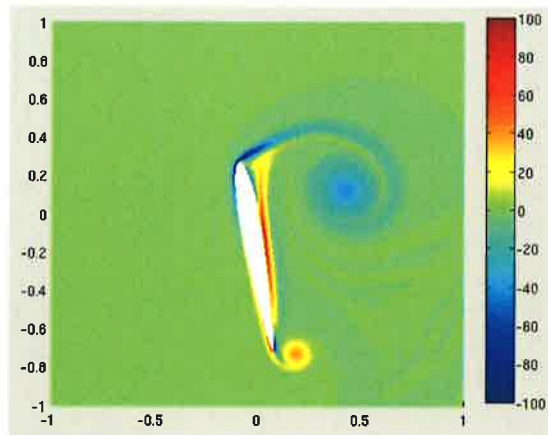
1. Part I Observing 3 Cases for k_θ and k_y

Figure 1: Screenshot of Wing Flutter CFD for $k_\theta = 0.1$ and $k_y = 0.1$.

The Wing Flutter for figure 1 above displayed significant pitching and heaving behavior. This is expected because of the low values for both the pitching and heaving spring constants.
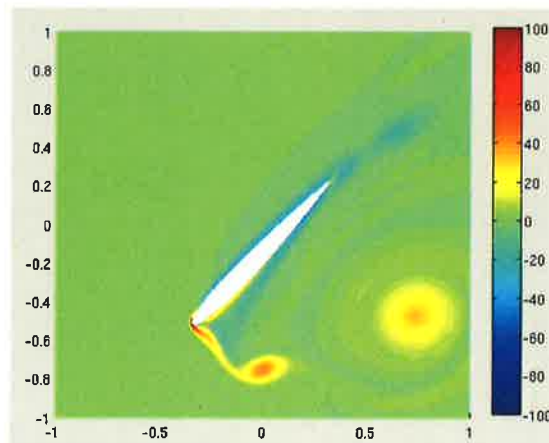

Figure 2: Screenshot of Wing Flutter CFD for $k_\theta = 0.1$ and $k_y = 3$.

The Wing Flutter for figure 2 above displayed much pitching behavior but little heaving behavior. This is because the pitching constant was small while the heaving constant was increased by an order of magnitude from the value in figure 1.
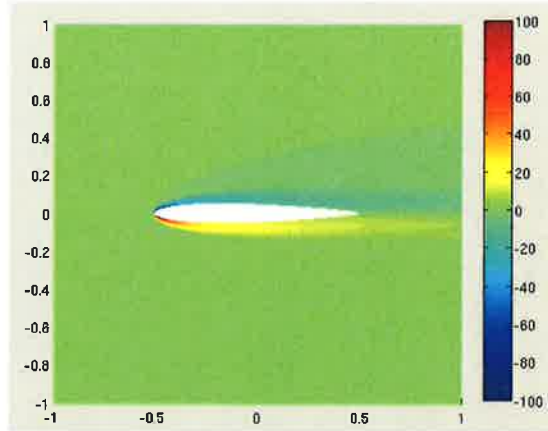
Figure 3: Screenshot of Wing Flutter CFD for $k_\theta = 0.5$ and $k_y = 0.5$.

The Wing Flutter for figure 3 above displayed neither pitching nor heaving behavior. This is attributed to the relatively large values for k_θ and k_y. Because of this, both "springs" work together to keep the wing from fluttering.

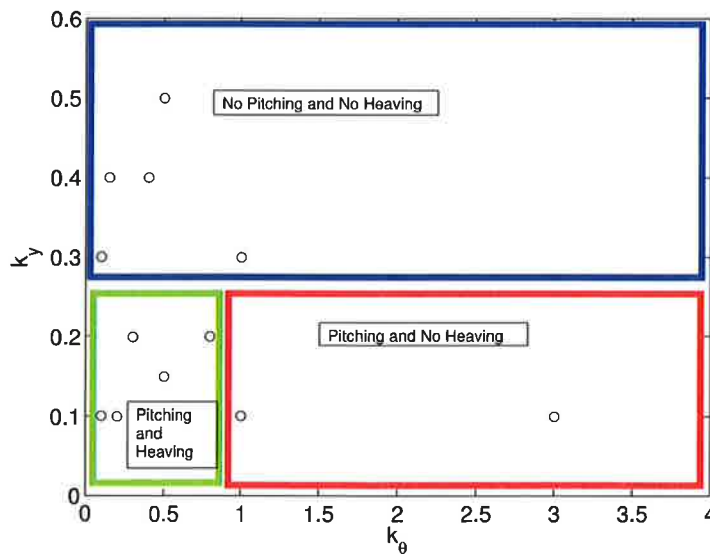## 1. Part II Identifying Fluttering Behavior Based off of Various Values for k_θ and k_y

Figure 4: Behavior of wing flutter according to various values for k_θ and k_y.

I tested 12 combinations of k_θ and k_y using wingflutter16dec01.f and observed the behavior of the wing. For $k_y >$ approximately 0.3 and any value of k_θ, there was neither heaving nor pitching. For $k_y < 0.3$ and $k_\theta >$ approximately 1, there was only pitching. Finally, for $k_y < 0.3$ and $k_\theta <$

2

approximately 1, there is both pitching and heaving. These results can be seen above in figure 4. Table 1 below shows the tabular results used to create figure 4

Table 1: Flutter Results for Various Values of k_y and k_θ			
k_y	k_θ	Heaving Behavior	Pitching Behavior
0.1	0.1	Yes	Yes
3	0.1	Very Little	Yes
0.5	0.5	No	No
1	0.1	Little	Yes
1	0.3	Little	Little
0.3	0.2	Yes	Yes
0.4	0.4	No	No
0.2	0.1	Moderate	Yes
0.15	0.4	No	No
0.1	0.3	No	No
0.5	0.15	Yes	Yes
0.8	.02	Yes	Yes