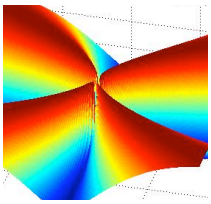
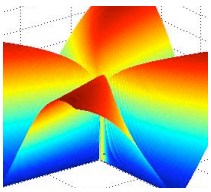


M254H HW 3

Due Monday Feb. 3



From Adams and Essex

Chapter	Page Number	Problems
11.1	592	12, 18, 20, 24, 30
11.2	634	2, 4, 5
11.3	641	9, 17, 18, 24
11.4	649	4, 8

Non-book Exercises

1) Consider a ball starting at $\vec{r}_0 \in \mathbb{R}^3$ at time $t = 0$ with initial velocity $\vec{v}_0 \in \mathbb{R}^3$. Suppose there is a constant wind with direction $\vec{w}$ which is orthogonal to the vertical vector $\vec{k}$. Using the same evolution equation as in class

$$m\frac{d\vec{v}}{dt} = -mg\vec{k} + \nu\vec{w}\frac{(\vec{w}-\vec{v})\cdot\vec{w}}{|\vec{w}|^2},$$

determine the evolution for the velocity $\vec{v} = \vec{v}(t)$. The difference with the example in class is that we do not assume that the initial projective velocity $\vec{v}_0$ lies in the plane formed by $\vec{k}$ and $\vec{w}$. Determine the differential equations for the position $\vec{r} = \vec{r}(t)$, you do not need to solve them.

2) Suppose you are given a point $\vec{r}_0 \in \mathbb{R}^3$ and two lines

$$\begin{aligned} \mathbb{L}_1 &:= \left\{ \vec{r}_1 + t\vec{v}_1 \,\middle|\, t \in \mathbb{R} \right\}, \\ \mathbb{L}_2 &:= \left\{ \vec{r}_2 + s\vec{v}_2 \,\middle|\, s \in \mathbb{R} \right\}. \end{aligned}$$

Determine conditions on $\vec{r}_0, \vec{r}_1, \vec{r}_2$ and $\vec{v}_1, \vec{v}_2$ such that there is a single line $\mathbb{L}$ which passes through $\vec{r}_0$ and the two lines $\mathbb{L}_1$ and $\mathbb{L}_2$. Extra credit: determine the equation of the line $\mathbb{L}$.