Notes in APPM 4650
Adam Norris

Zachary Vogel

November 13, 2015

1 Still doing project

few remaining words about explosion problem.
In theory you have:

$$\frac{d\theta}{d\sigma} = \delta e^{\theta} - \theta$$

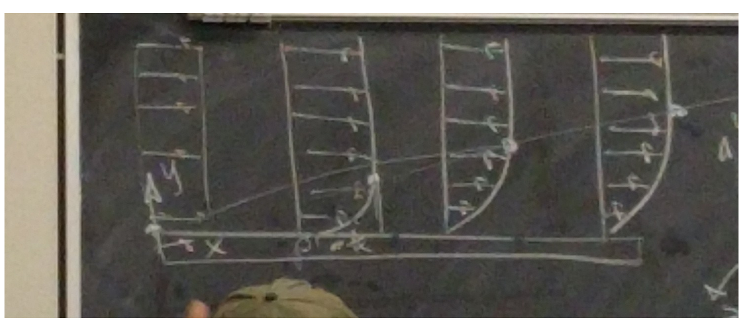
stiff problem.

$$\sigma_{\text{explosion}} = \int_0^{\infty} \frac{dx}{\delta e^x - x}$$

where infinity is big enugh so that the value of the integral doesn't change.

Thus, we have project 1.

2 Project 2



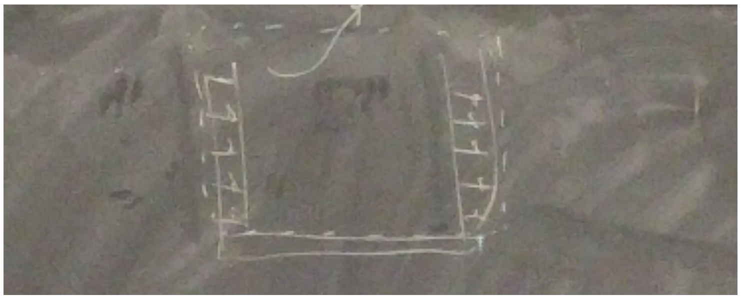
fluid flowing from left to right, flowing at velocity of u_∞.
generic velocity:

$$v = u\hat{i} + \mathfrak{v}\hat{j} + 0\hat{k} = u(x, y)\hat{i} + \mathfrak{v}(x, y)\hat{j} + 0\hat{k}$$

it's all horizontal as it approaches a flat plate.
when you first hit the plate:

$$v = u_\infty\hat{i} + 0\hat{j} + 0\hat{k}$$

prior to $x = 0$. $\delta_m(x)$ momentum boundary layer thickness.
goal is to find
$u(x, y) = \ldots, \quad v(x, y) = \ldots$



divergence is the stuff coming out from every point.
$v \neq 0$

$$u_x + u_y = 0$$

conservation of mass.

$$uu_x + \mathfrak{v}u_y = \nu u_{yy}$$

conservation of x momentum.

$$\frac{du}{dt} + (v_0\nabla)u = v\nabla^2 u$$

$\frac{du}{dt}$ is gone by s.s.

also, the plate is hot and the fluid is cold, so now we get to worry about that.
conservation of mass: $u_x + u_y = 0$
conservation of momentum: $uu_x + \mathfrak{v}V_y = \nu u_{yy}$
$\nu \sim$ kinematic viscosity$= \frac{\mu}{\rho}$
$\mu \sim$ dynamic viscosity
$\rho \sim$ mass density $\frac{\text{mass}}{\text{velocity}}$.

temperature of different regions as they pass over the hot plate. The further down you go, the thicker the region that has been warmed up as you can see.
temp stays at relatively the same temperature.
ever growing thickness known as δ_T δ thermal.
There you make a transition from T_∞ to T_{wall}.
Conservation of thermal energy:

$$U\frac{\partial T}{\partial x} + \mathfrak{v}\frac{\partial T}{\partial y} = \alpha\frac{\partial^2 T}{\partial y^2}$$

convection and thermal diffusion.
$\alpha = \frac{k}{\rho c_p}$ thermal diffusivity.