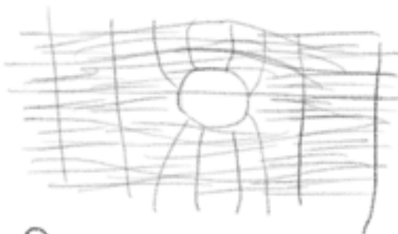
Complex Plane



- Fast where vertical lines are close
- Slow where vertical lines far

$f(z) = z + \frac{1}{z}$

Two things at Play

Divergence

$\nabla \cdot \vec{v}$

Curl

$\nabla \times \vec{v}$

Vector Field — associate each point in space with a vector (magnitude & direction

$\operatorname{div}\overbrace{F}^{\text{Vector Field Function}}(x, y) =$

Measures

$\ldots(x, y) = +1.62$ — Some Point — Measures how much (x, y) generates fluid out(+) or into(−).

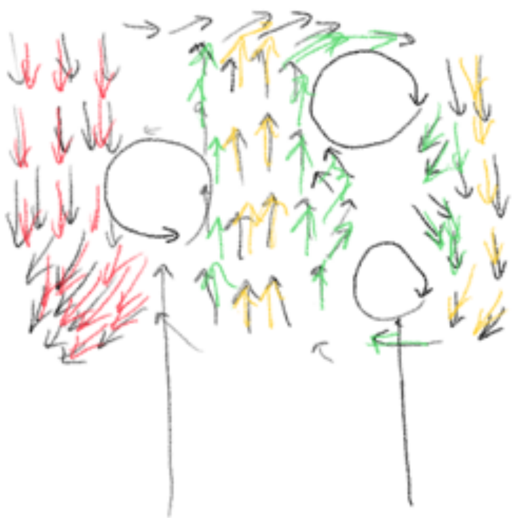
$$F(x,y) = \begin{bmatrix} z_1 \\ z_2 \end{bmatrix}$$

$\Rightarrow$ Analgous to a derivative.

* Side note if the diverge is 0 everywhere the fluid is uncompressable.

$$\operatorname{div} F = 0.$$

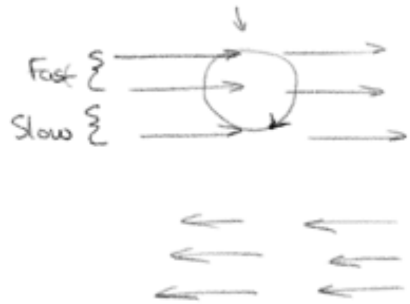
CURL



curlF>0 — *counter clockwise

curlF<0 — *clockwise

Net Clockwise influence still curlF<0

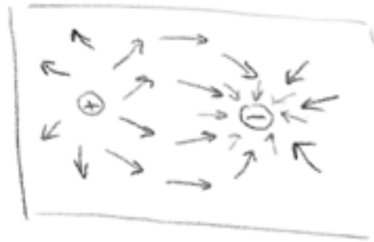


Maxwell's Equation's

Electric Field: $\mathcal{E}$ Magnetic Field: B

$\operatorname{div} E = \dfrac{\rho}{\varepsilon_0}$ ← Charge Density

Gauss' Law

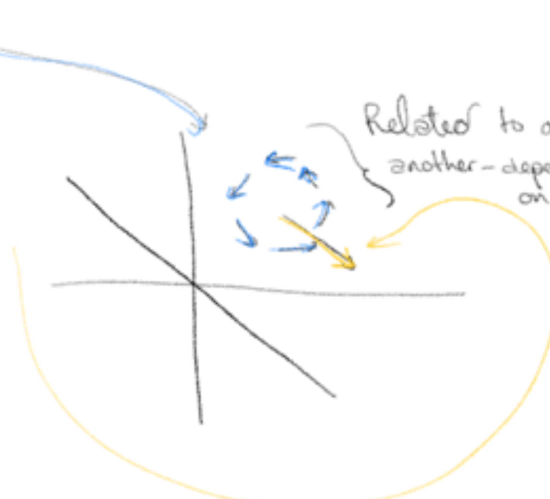


$\operatorname{div} B = 0$

The field is uncompressable
no sources or sinks.

$\operatorname{curl} E = \dfrac{\partial B}{\partial t}$

$\operatorname{curl} B = \mu_0\left(J + \varepsilon_0 \dfrac{\partial E}{\partial t}\right)$



Related to one another - depend on curl of each other.

* Divergence and curl are independent of flow

Divergence, Curl, Dot Product and Cross Product.

Divergence $= \nabla \cdot \vec{v}$, and the dot product calculates how similar two vectors are

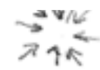
$\vec{u} \cdot \vec{v} = +/-$ diff

$+$ is outward flow

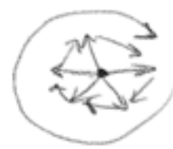
$-$ is sink.

dot is $+$

Cross Product Measures how perpendicular two vectors are.

 dot is −

cross prod is +, when clockwise



C.P is −.

Divergence, curl and incompressible irrotational flow

$\operatorname{div} F = 0$

$\operatorname{curl} F = 0.$

- Like no charges or current in a vacuum.