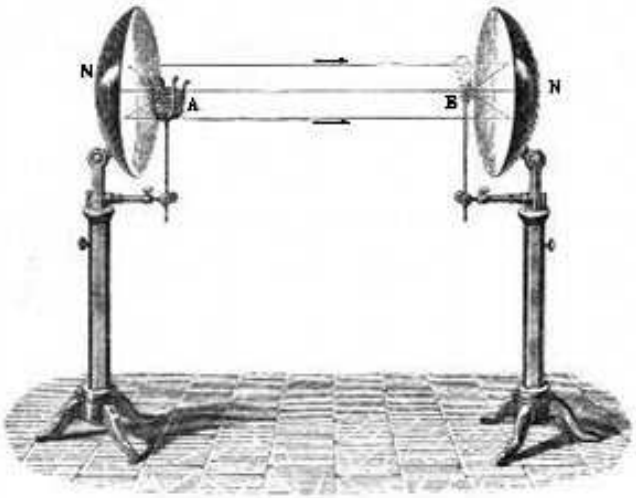
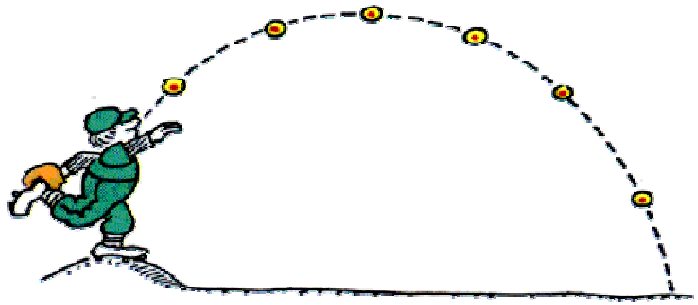
Some applications of Quadratic Equations

Dr Andrew French



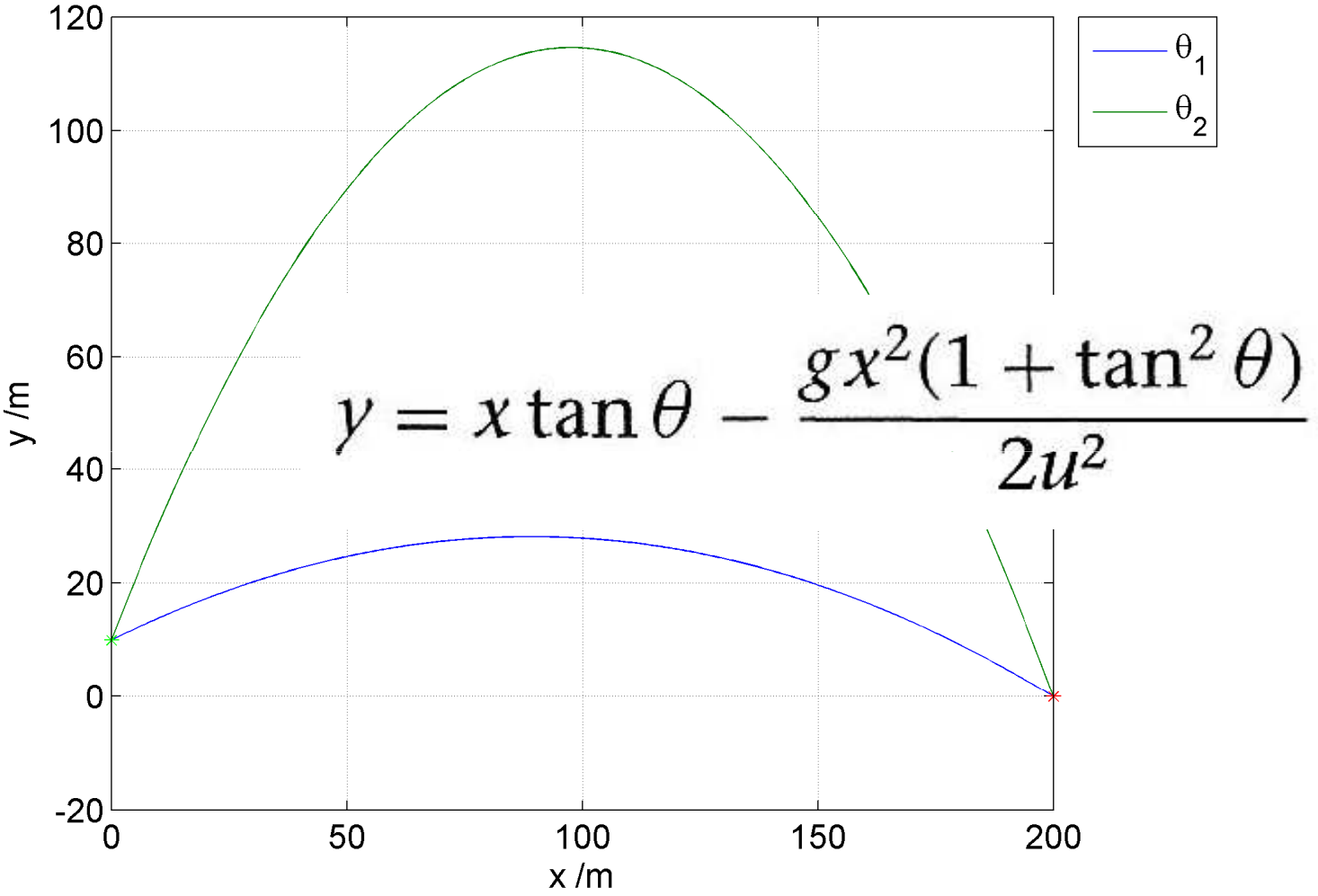
Parabolic reflectors



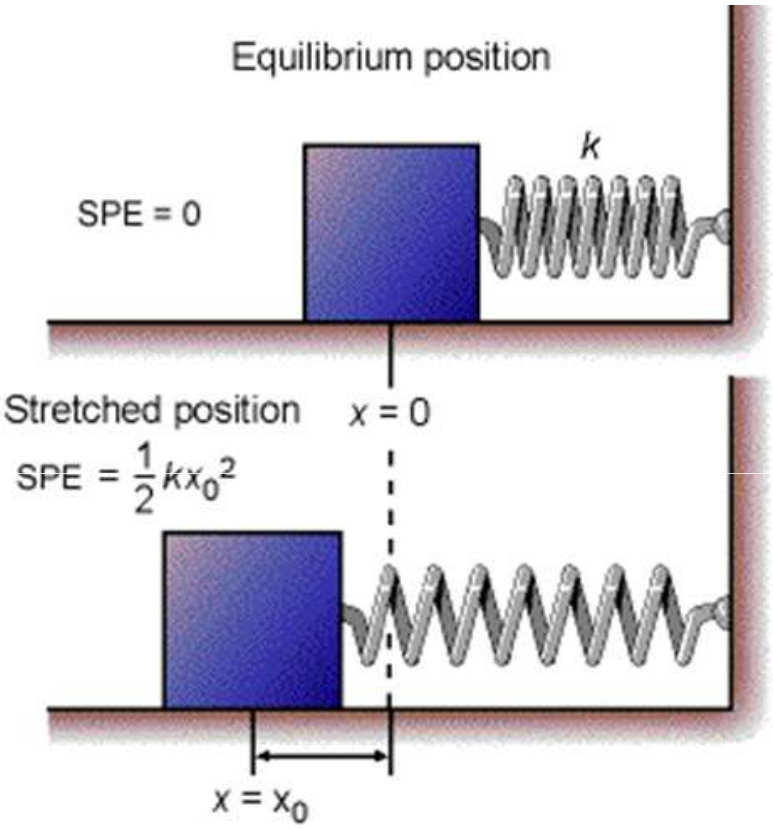
PROJECTILE: u = 50.0ms^{-1}
θ_1 = 22.2°, T_1 = 4.3s. v_1 = 51.9ms^{-1}
θ_2 = 65.0°, T_2 = 9.5s. v_2 = 51.9ms^{-1}

Projectile motion

$g = 9.81\text{ms}^{-2}$

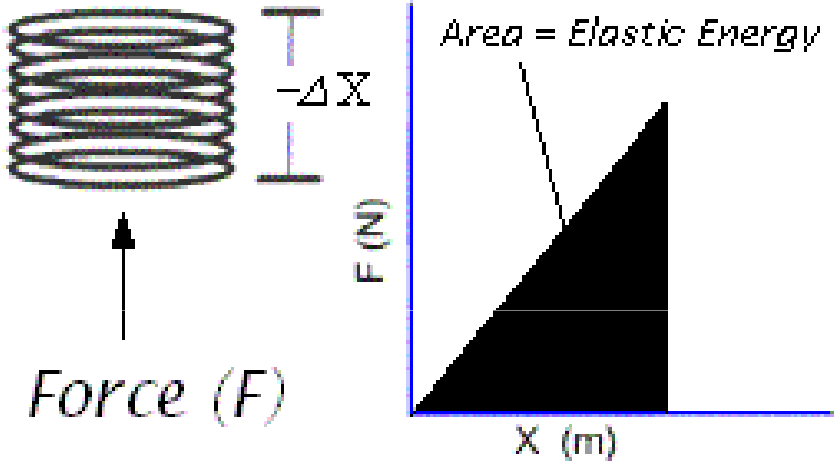


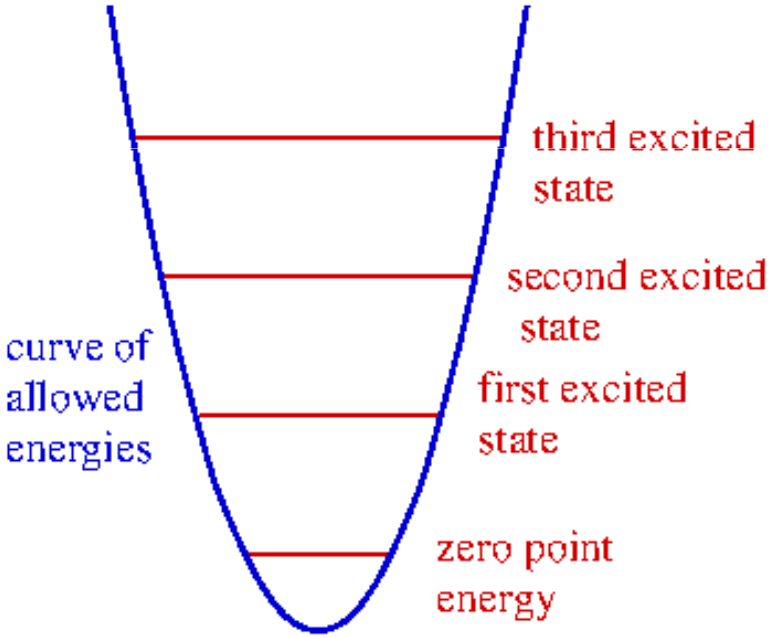
$$y = x\tan\theta - \frac{gx^2(1+\tan^2\theta)}{2u^2}$$



Potential energy in springs

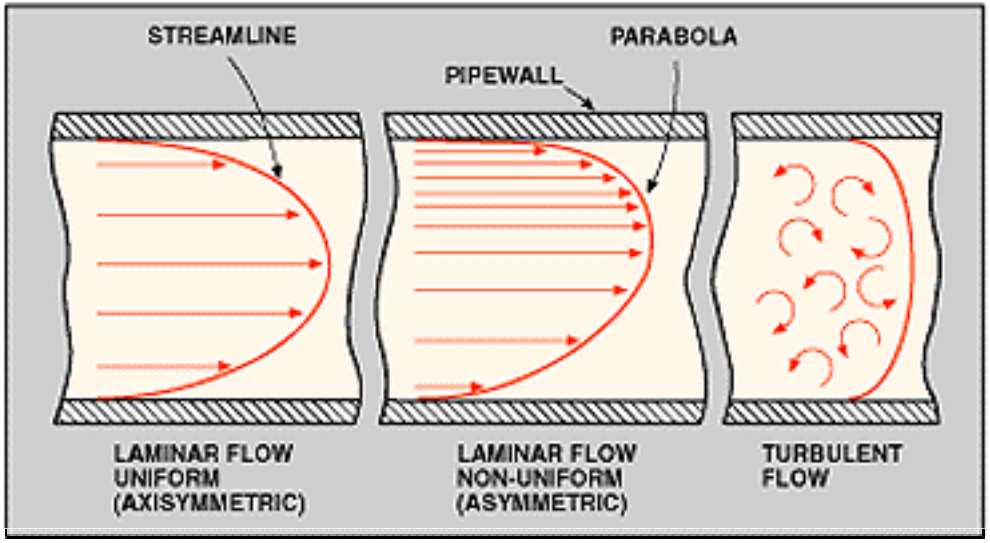
From car suspension to vibration of molecules!



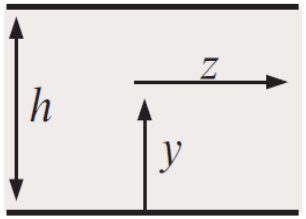


$$F = kx$$

$$E = \int F dx = \int kx dx = \tfrac{1}{2}kx^2 + c$$



$$v_z(y) = \frac{1}{2\eta} y(h-y) \frac{\partial p}{\partial z}$$



Velocity profile of fluids in a river or pipe

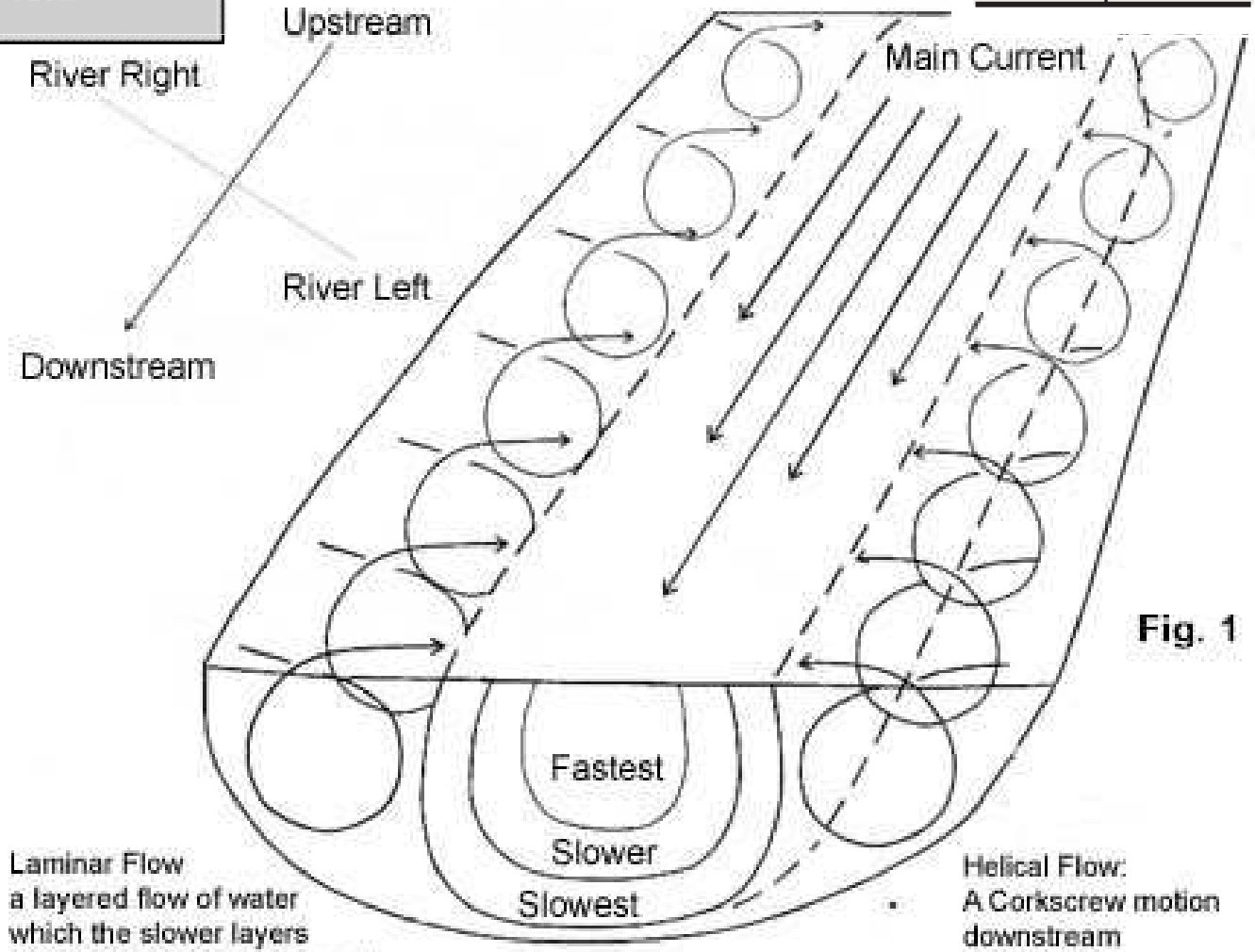


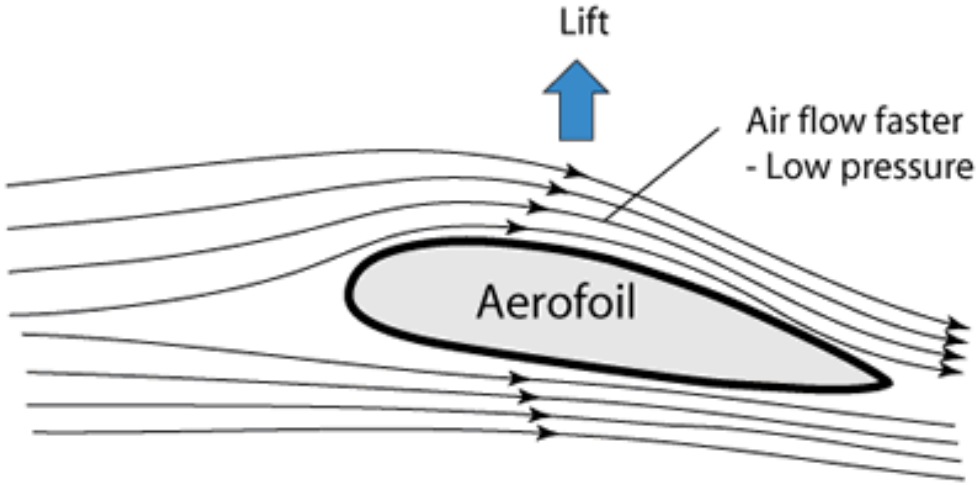
Fig. 1

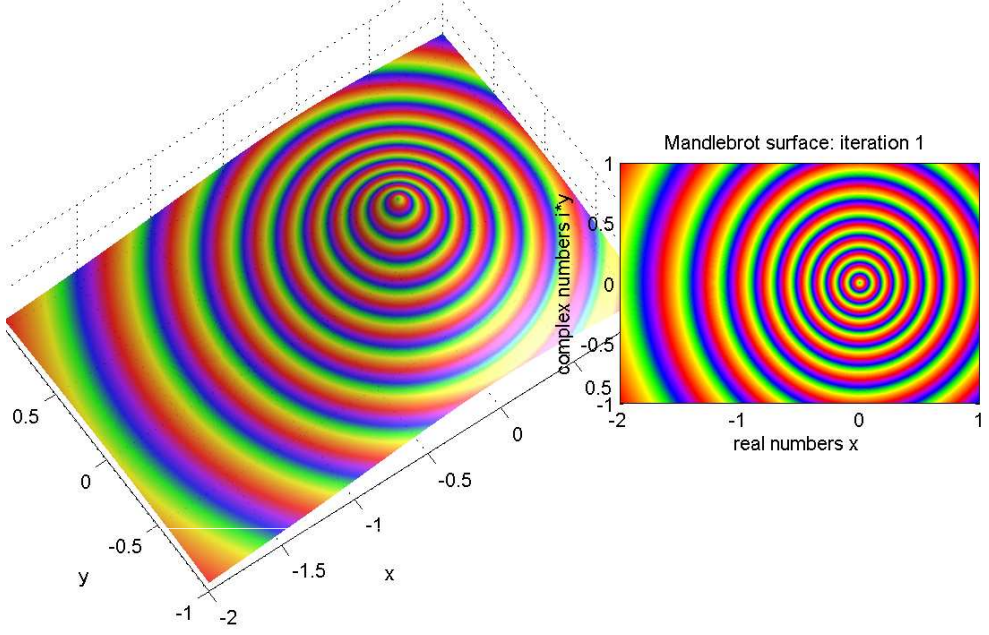
Laminar Flow
a layered flow of water which the slower layers push against the banks and bottom The Fastest layers are on top in mid stream

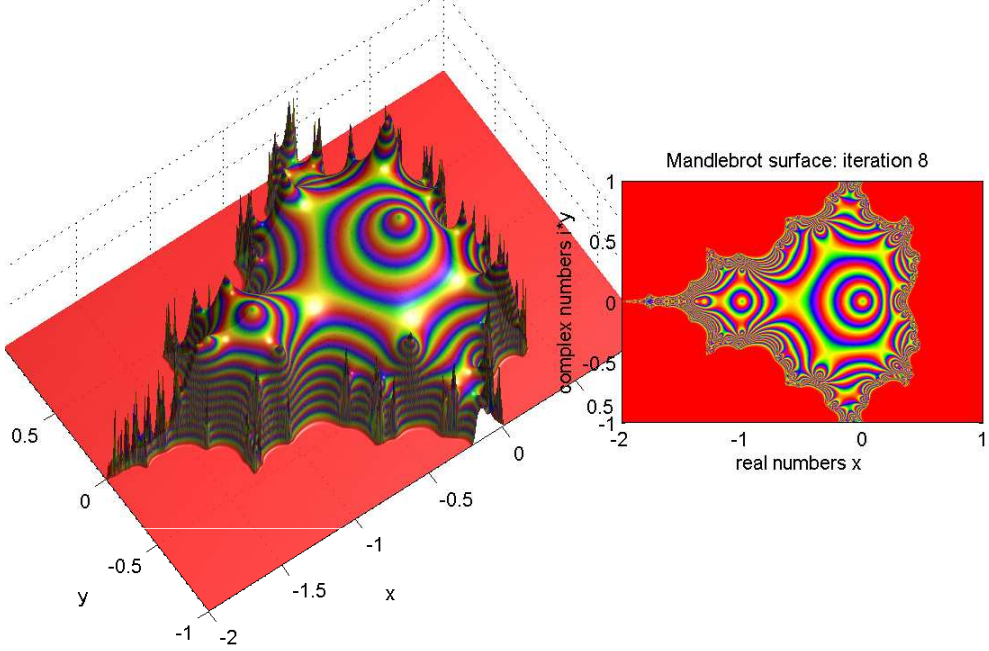
Helical Flow:
A Corkscrew motion downstream

Bernoulli's equation (incompressible flow)

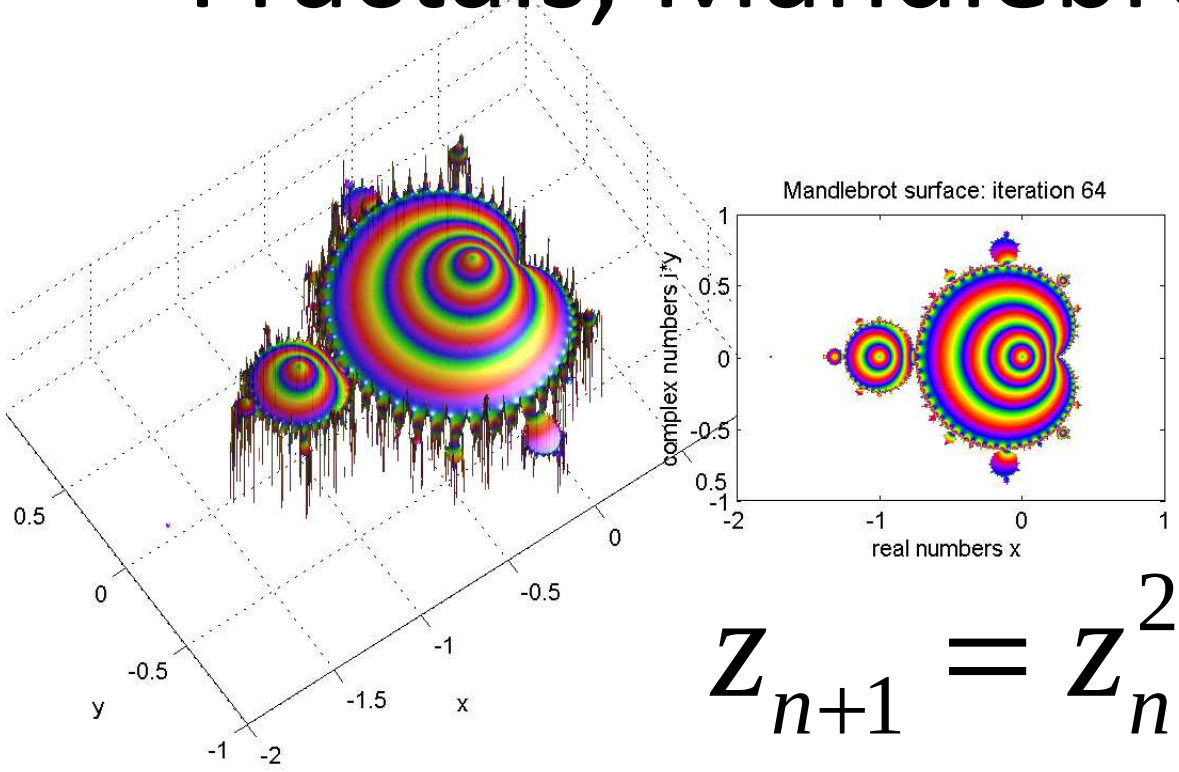
$$\frac{1}{2}\rho v^2 + p + \rho g z = \text{constant}$$

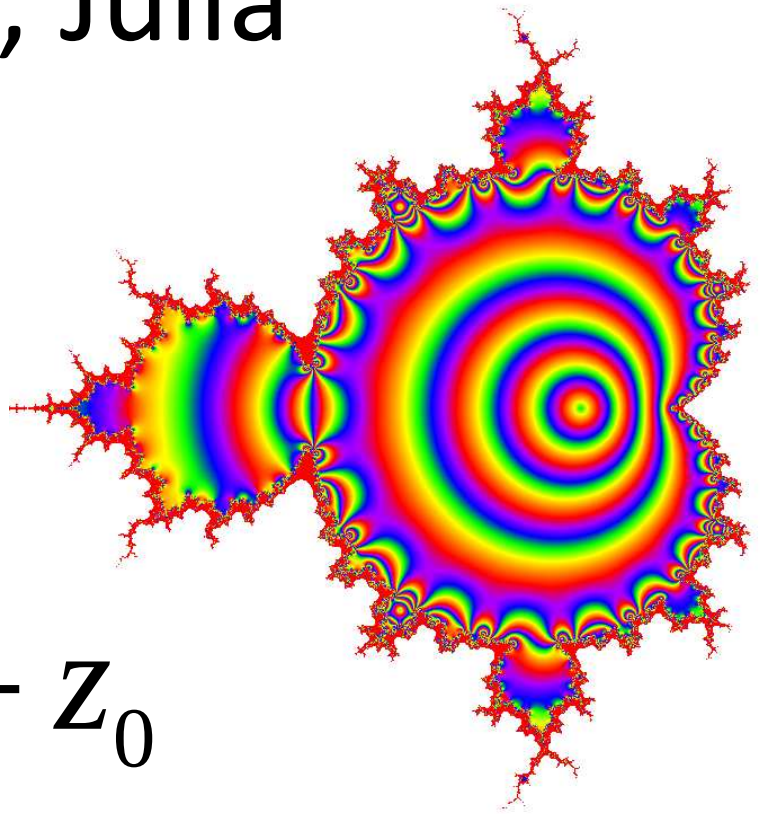






Fractals, Mandlebrot, Julia





$$z_{n+1} = z_n^2 + z_0$$