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Assignment 6 – ENSC 180

1)

a)

Factors of f1

[$x + 4$, $3x - 1$, $2x - 1$]

Factors of f2

[$x - 3$, $1/(x + 2)$]

Simplify $f1*f2$

$(6x^4 + x^3 - 76x^2 + 61x - 12)/(x + 2)$

$f1/f2 =$

$((x^2 - 4)*(6x^3 + 19x^2 - 19x + 4))/(x^2 - 5x + 6)$

$(f1*f2)^2 =$

$((x^2 - 5x + 6)^2*(6x^3 + 19x^2 - 19x + 4)^2)/(x^2 - 4)^2$

$d/dx (f1) =$

$18x^2 + 38x - 19$

$d/dx (f2) =$

$(2x - 5)/(x^2 - 4) - (2x*(x^2 - 5x + 6))/(x^2 - 4)^2$

b)

Integral of f1 from 2 to 4 w.r.t x

$1826/3$

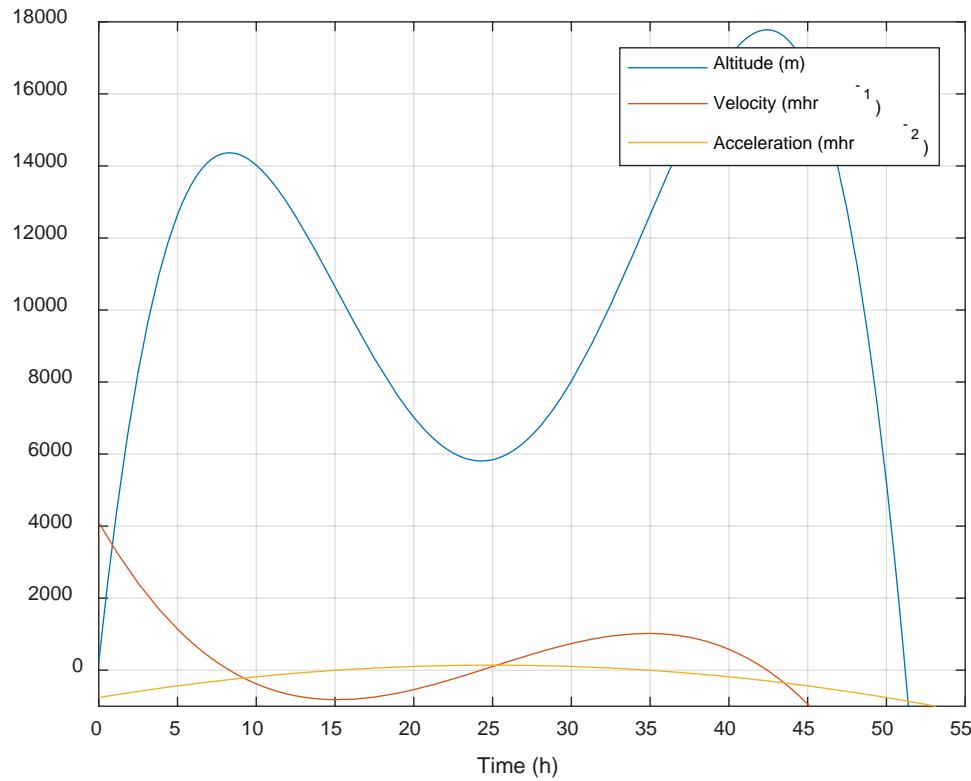
Integral of f1 from 2 to 4 w.r.t x

$\log(32/243) + 2$

c)

The balloon reaches maximum height 17778.66 metres after 42.42 hours.

The balloon reaches the ground at 51.19 hours



2)

a)

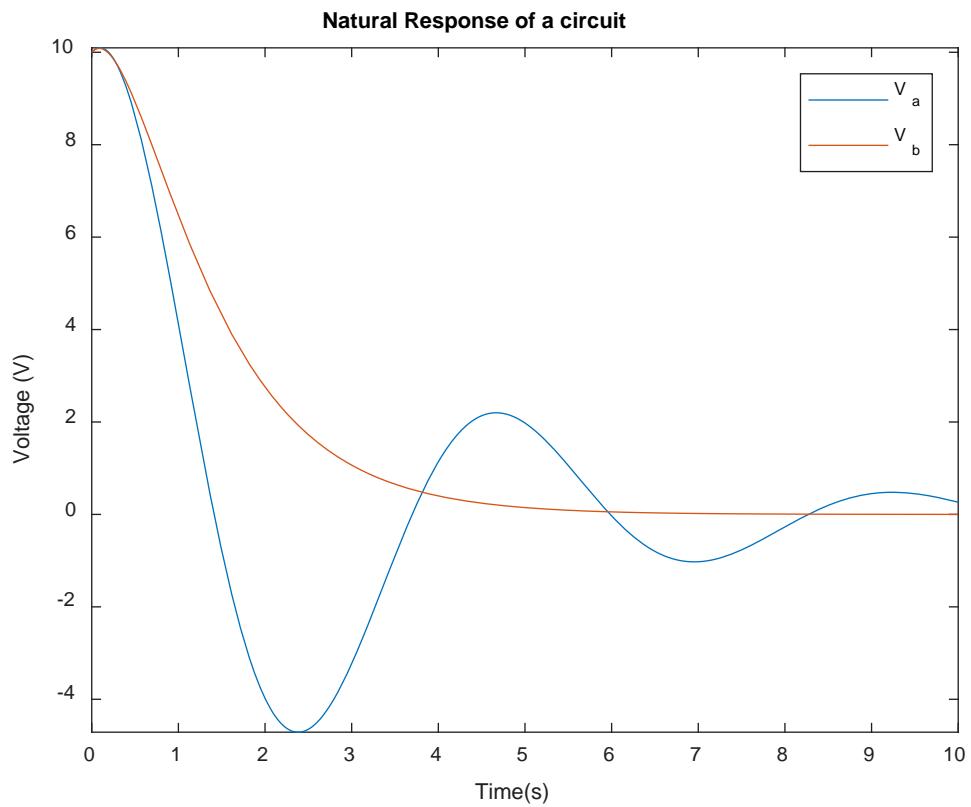
$$-\frac{(17^{(1/2)} \exp(t((17^{(1/2)} 5i)/3 - 1/3)) ((17^{(1/2)} 5i)/3 + 8/3) 3i)/17 - (17^{(1/2)} \exp(-t((17^{(1/2)} 1i)/3 + 1/3)) ((17^{(1/2)} 5i)/3 - 8/3) 3i)/17}{\sqrt{17}}$$

I put this into Wolfram Alpha and this is what I got:

$$\frac{3i\left(\frac{8}{3} + \frac{5i\sqrt{17}}{3}\right)e^{\left(-\frac{1}{3} + \frac{i\sqrt{17}}{3}\right)t} - 3i\left(-\frac{8}{3} + \frac{5i\sqrt{17}}{3}\right)e^{-\left(\frac{1}{3} + \frac{i\sqrt{17}}{3}\right)t}}{\sqrt{17}}$$

b) $22e^{-t} - 12e^{-2t}$

$$22e^{-t} - 12e^{-2t}$$



The natural response of A is oscillating and converging to zero. The natural response of B decreases to zero but slower and all values are greater than zero. This is because the resistance in A is less than 1 and resistance in B is greater than 1.

3)

The forced response for $V_s=8V$ is:

v1 =

$$24 \cdot \exp(-2 \cdot t) - (46 \cdot \exp(-3 \cdot t)) / 3 + 4 / 3$$

The forced response for $V_s=3e^{-4t}$ is:

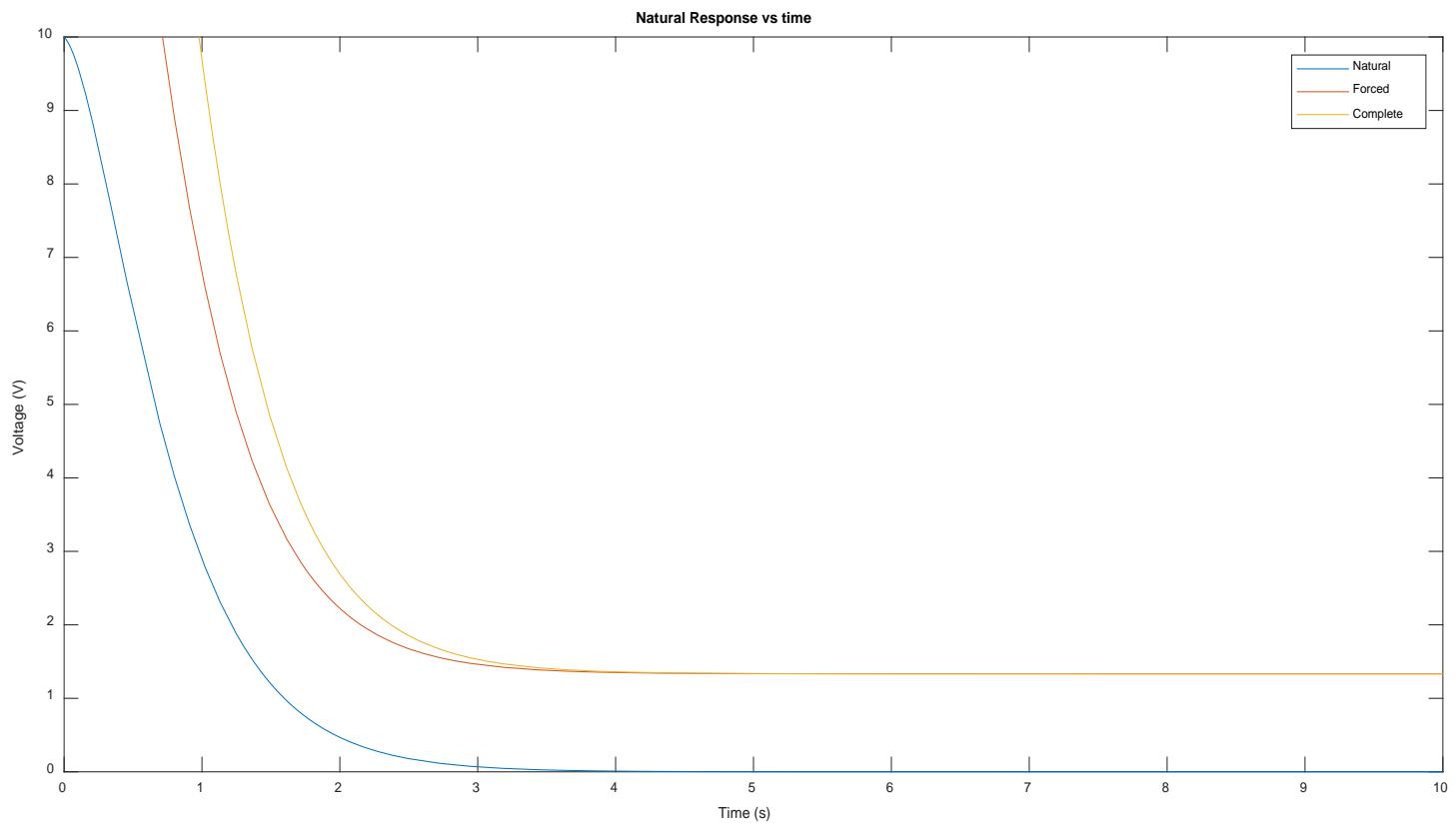
v2 =

$$(59 \cdot \exp(-2 \cdot t)) / 2 - 21 \cdot \exp(-3 \cdot t) + (3 \cdot \exp(-4 \cdot t)) / 2$$

The natural response is:

v4 =

$$28 \cdot \exp(-2 \cdot t) - 18 \cdot \exp(-3 \cdot t)$$



The natural response tends to zero compared to the forced and complete response which tend to a value $1 < V < 2$. This is since the complete response = natural response + forced response.

4)

`sol =`

$$- (Q \cdot L^3) / (3 \cdot \text{flexrig}) + (Q \cdot t \cdot L^2) / (2 \cdot \text{flexrig}) - (Q \cdot t^3) / (6 \cdot \text{flexrig})$$

Where Q is q_0 and $\text{flexrig} = EI$

`slope =`

$$(Q \cdot L^2) / (2 \cdot \text{flexrig}) - (Q \cdot t^2) / (2 \cdot \text{flexrig})$$

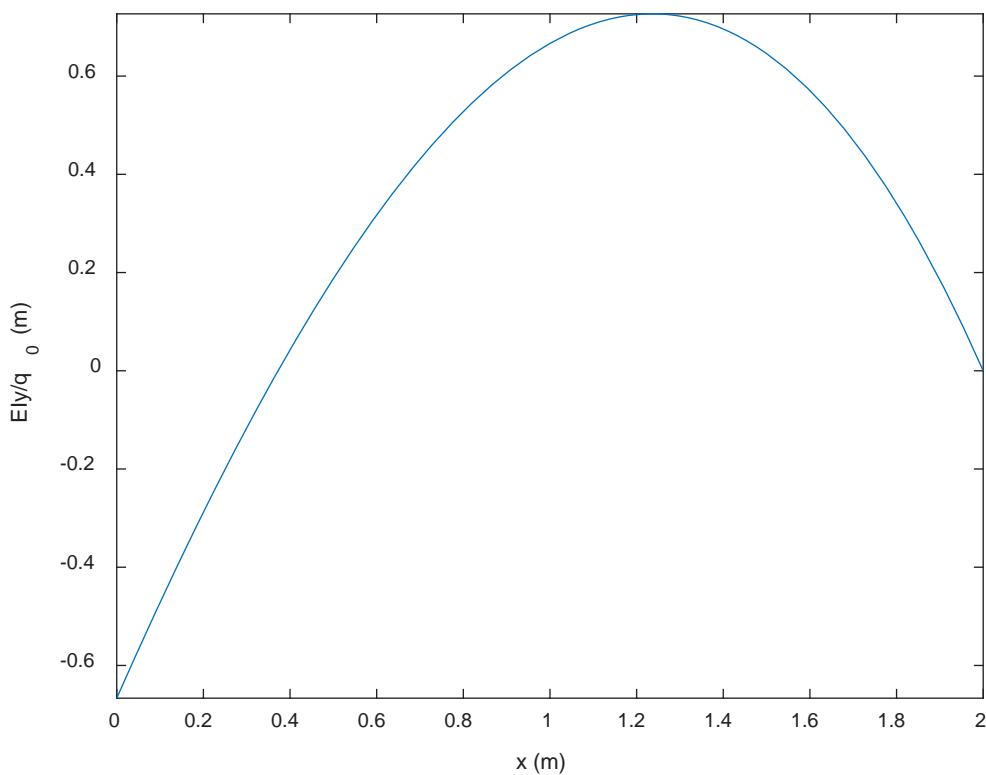
`esol =`

$$(2 \cdot Q \cdot t) / \text{flexrig} - (Q \cdot t^3) / (6 \cdot \text{flexrig}) - (8 \cdot Q) / (3 \cdot \text{flexrig})$$

`eslo =`

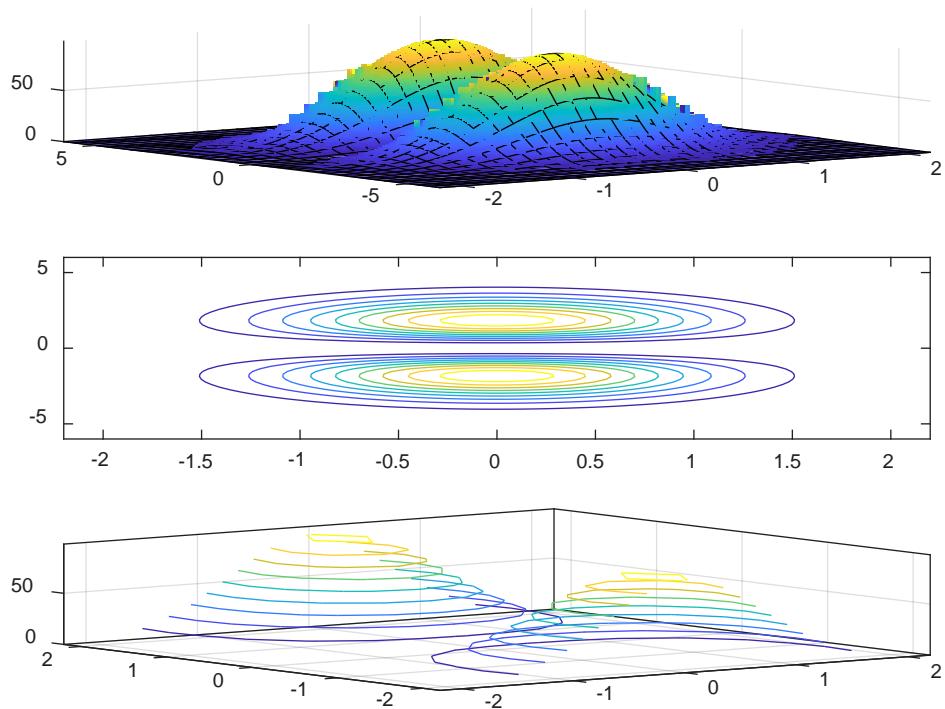
$$(2 \cdot Q) / \text{flexrig} - (Q \cdot t^2) / (2 \cdot \text{flexrig})$$

Deflection of 2m beam versus distance from free end

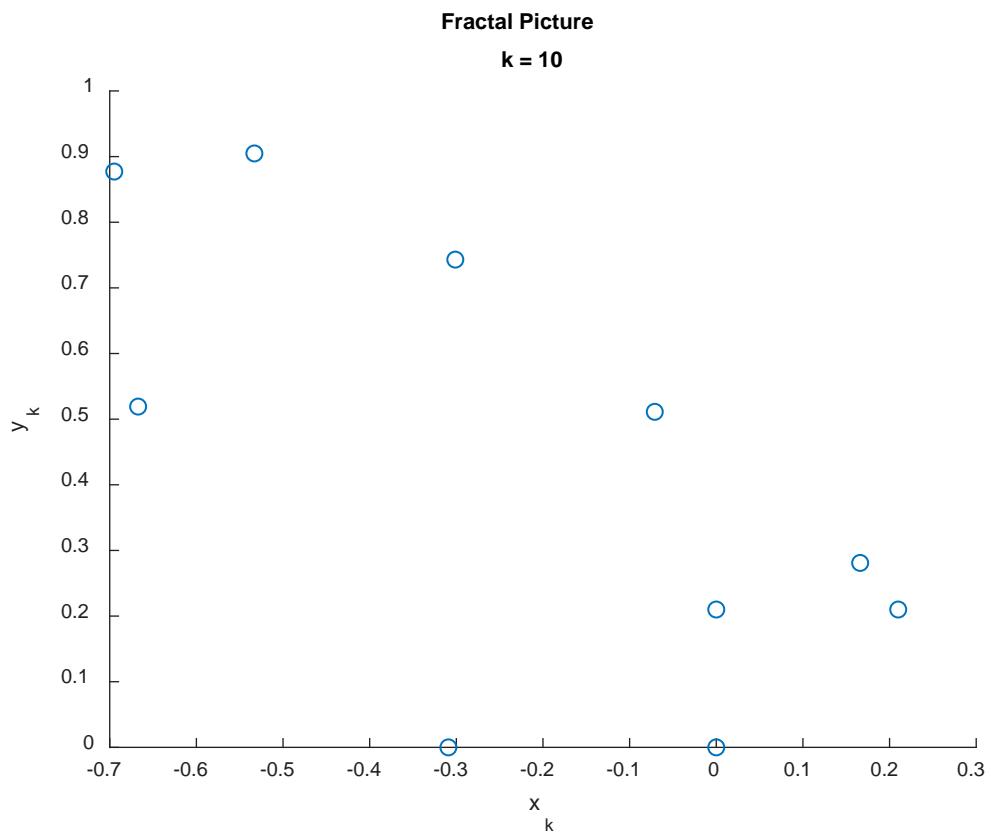


5)a)

Temperature distribution over a rectangular plate

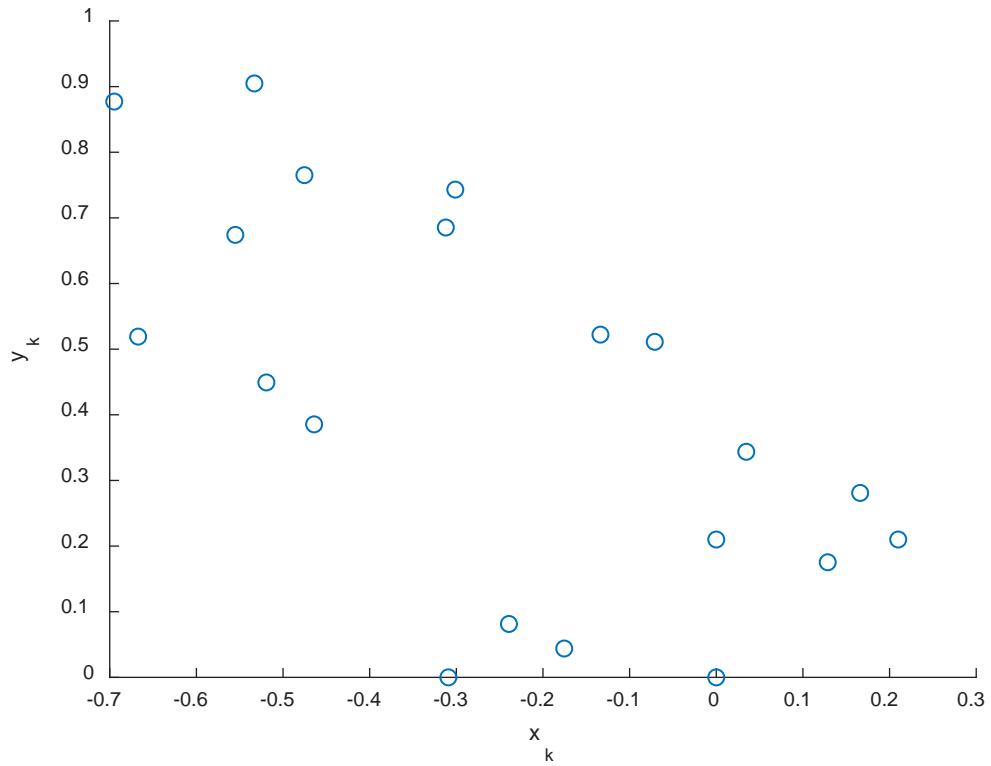


b)

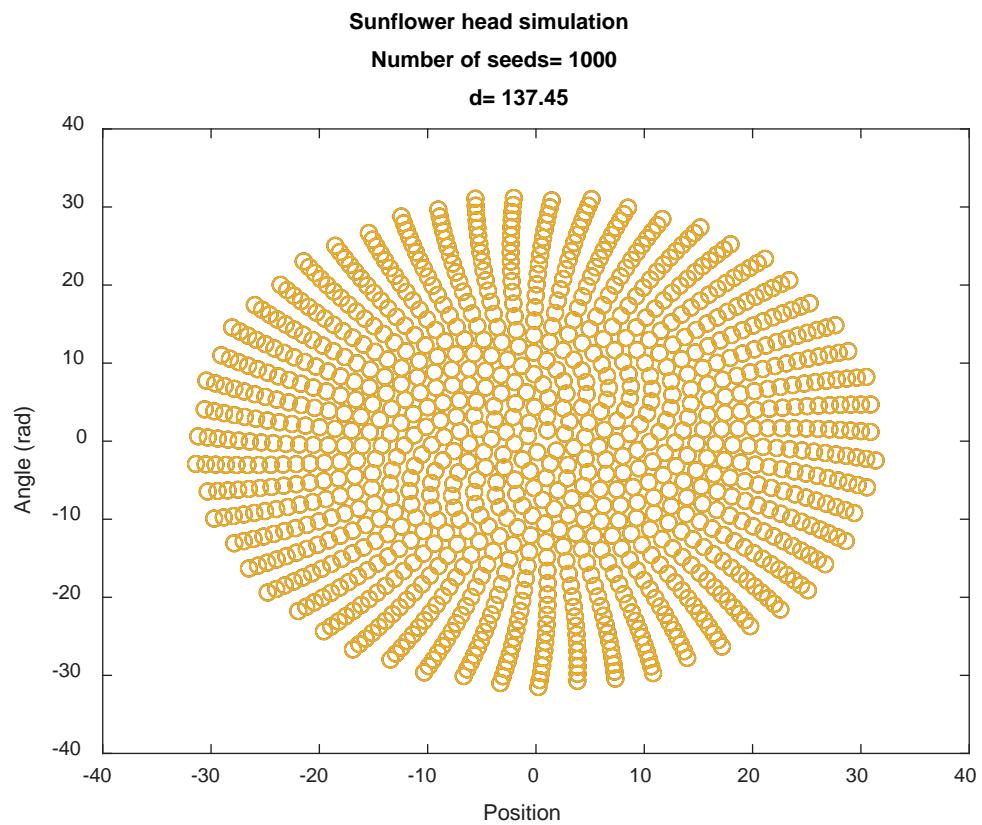
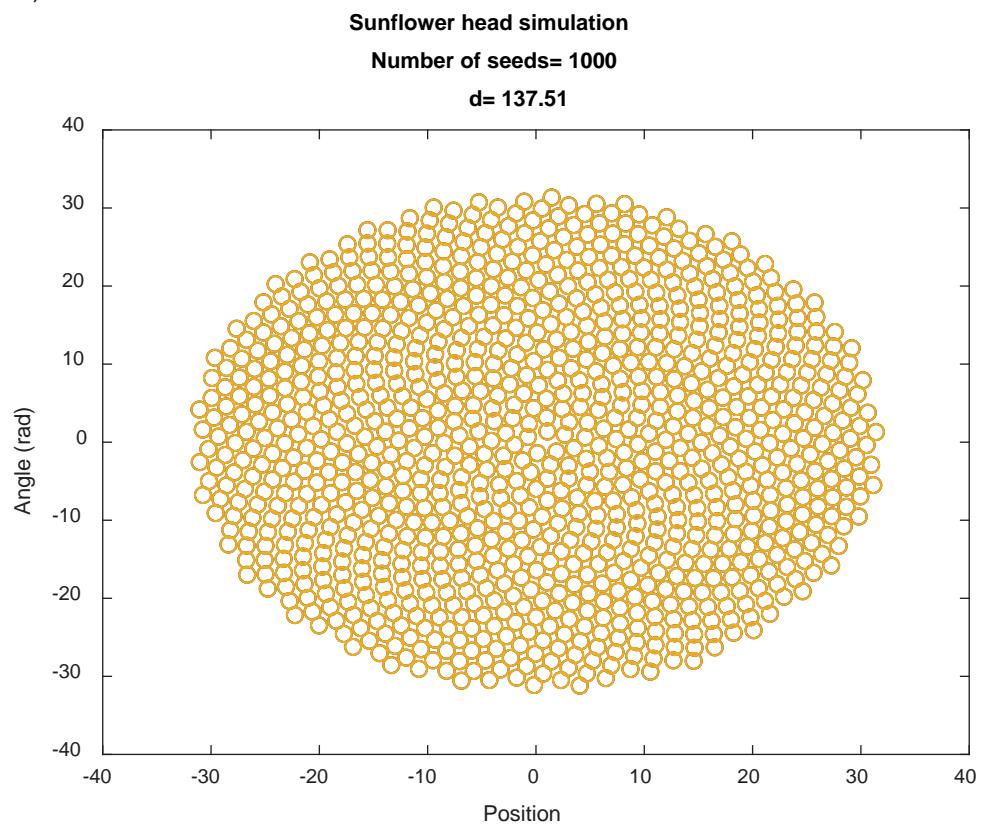


Fractal Picture

$k = 20$



5) c)



Sunflower head simulation

Number of seeds= 1000

d= 137.92

