



Matlab: building blocks

Lino Mediavilla

What is Matlab?

- Interactive Environment
- Matrix-based language
- Data analysis
- Models & Applications
- Sky is the limit

```
>> M = [1 6 7; 3 2 5; 6 9 0]
```

```
M =
```

```
     1     6     7
     3     2     5
     6     9     0
```

```
>> M(1,3)
```

```
ans =
```

```
7
```

Civil Engineering

Tension_GUI

Diseño a Tensión

Parametros

Acero

A36

Perfil

Cuadrado

Carga Muerta

22700

Carga Viva

45400

u

0.8

Diámetro de perno

0.45

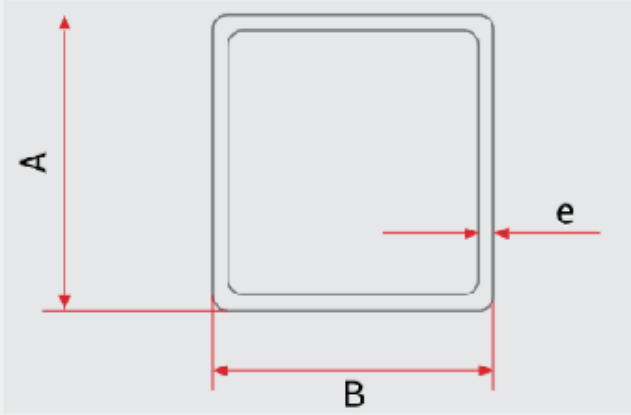
de pernos

2

Longitud

600

Resultados

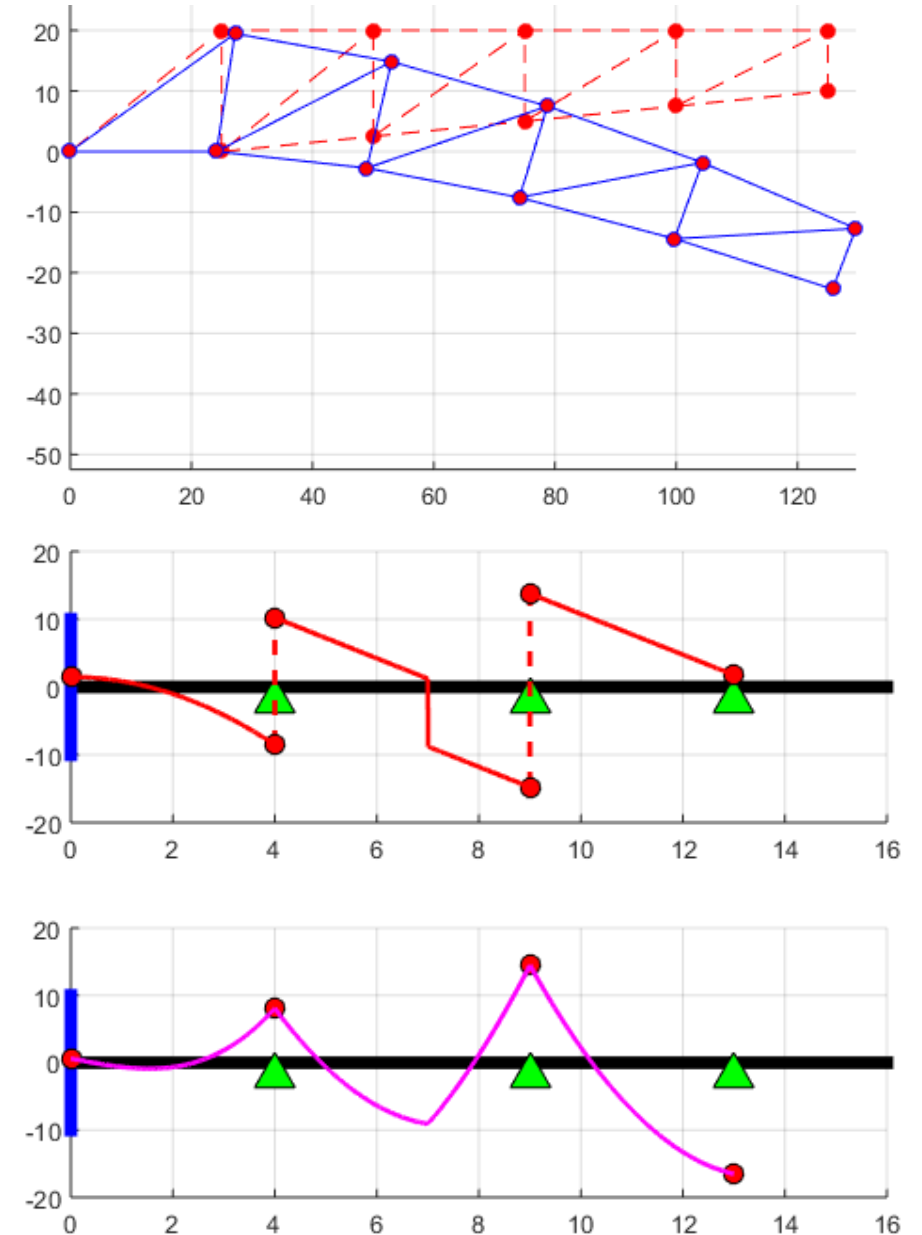


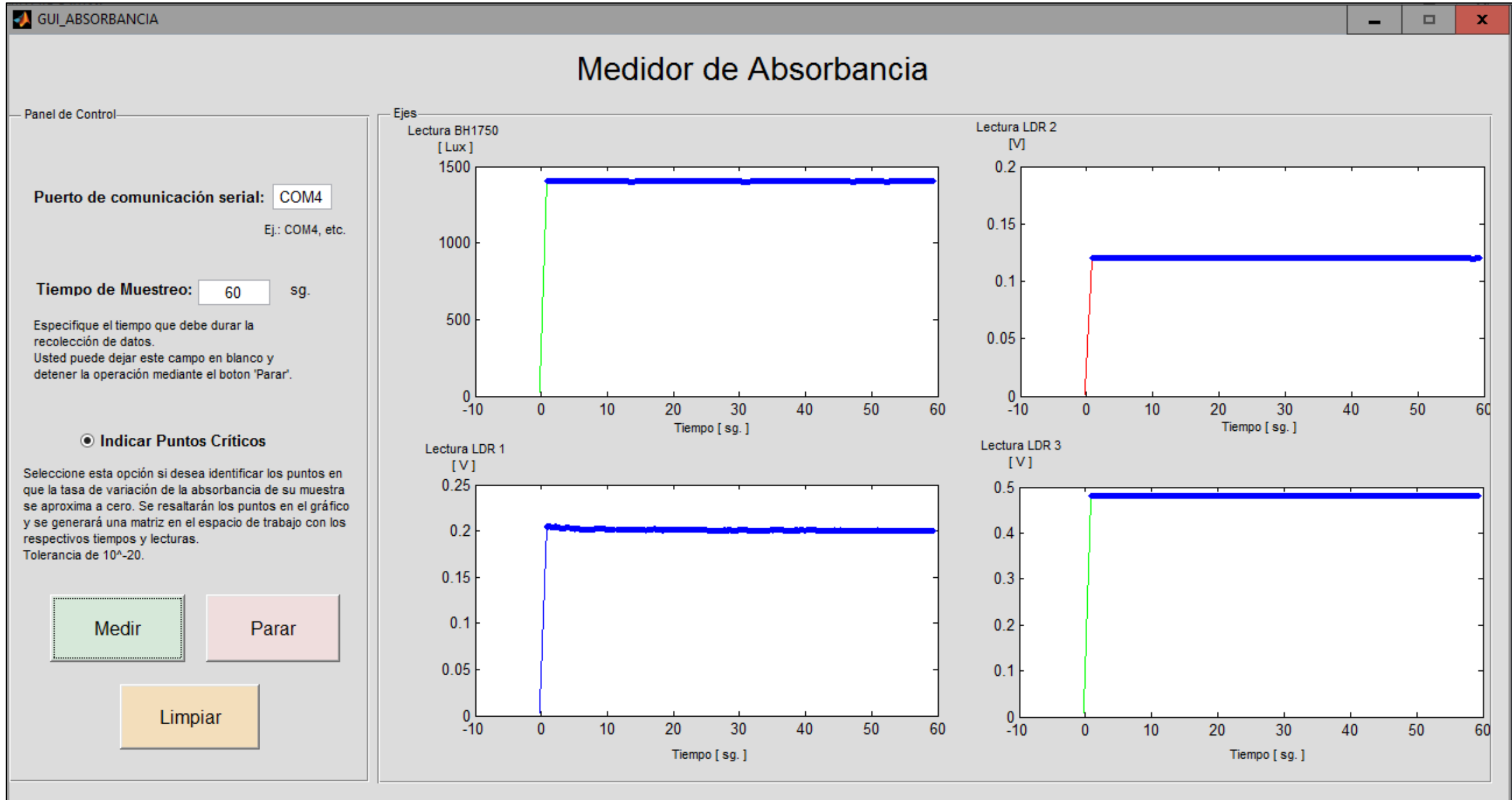
A: 20.000
B: 20.000
e: 0.600

Dimensiones Óptimas

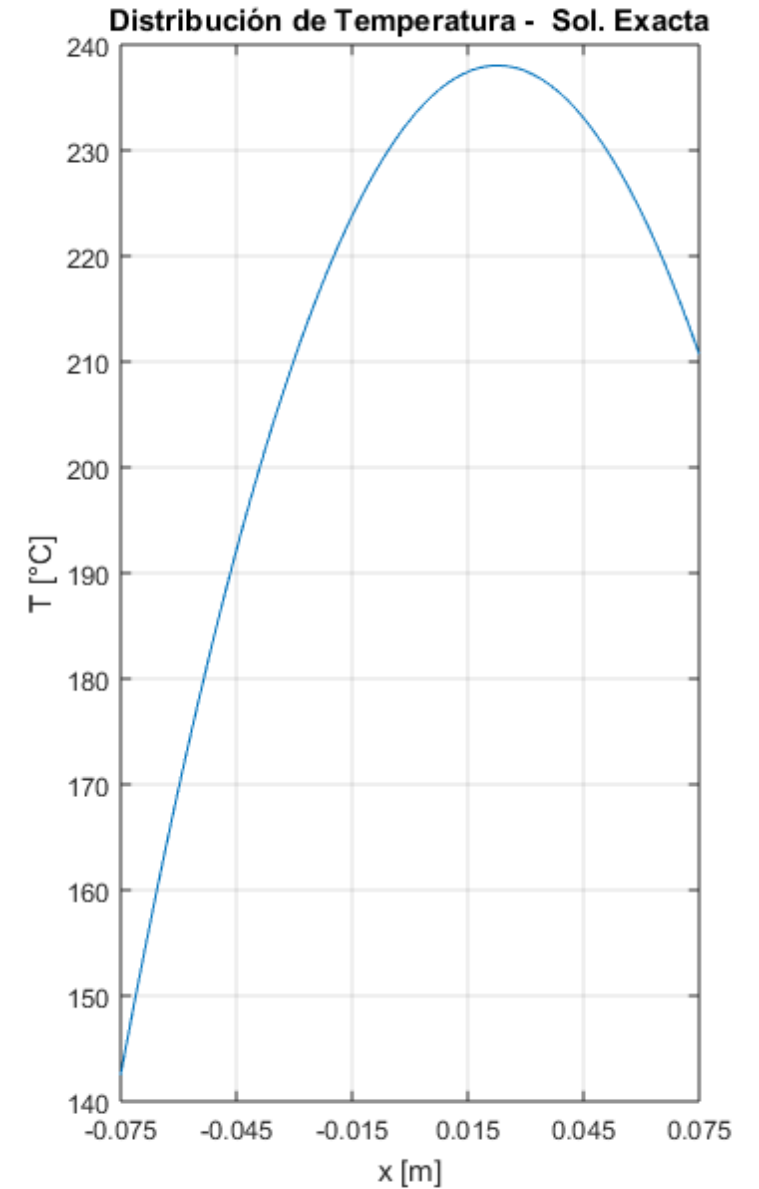
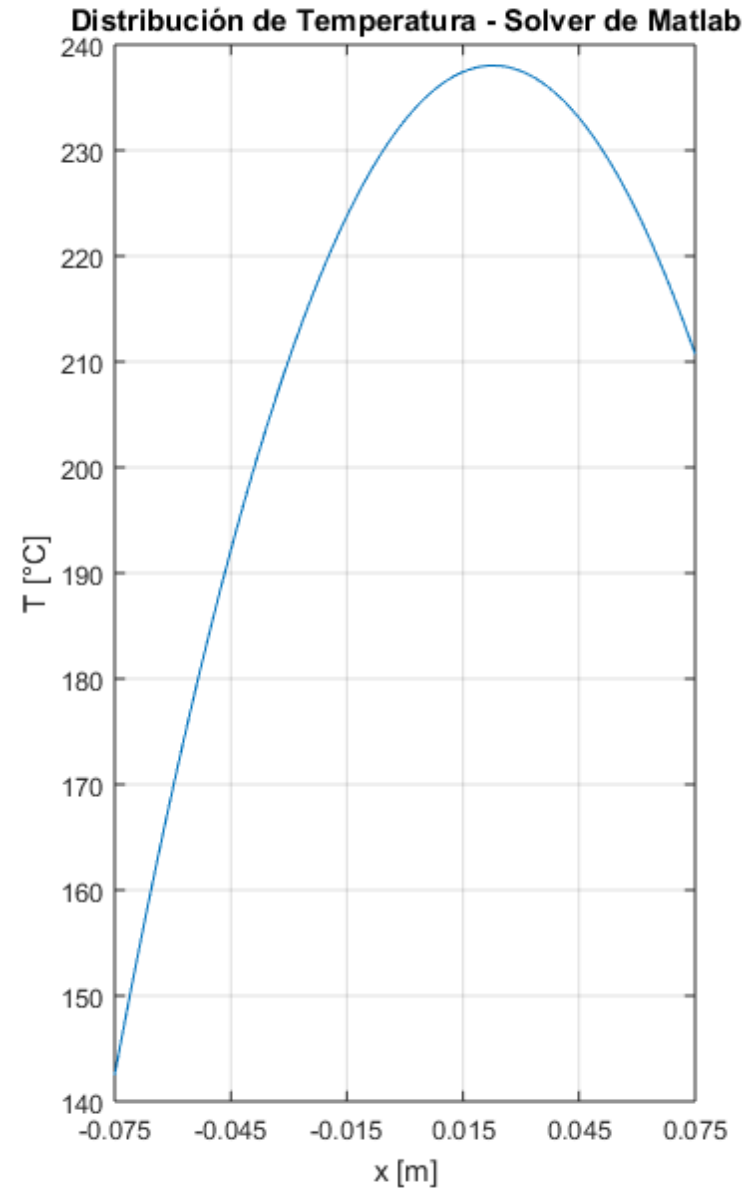
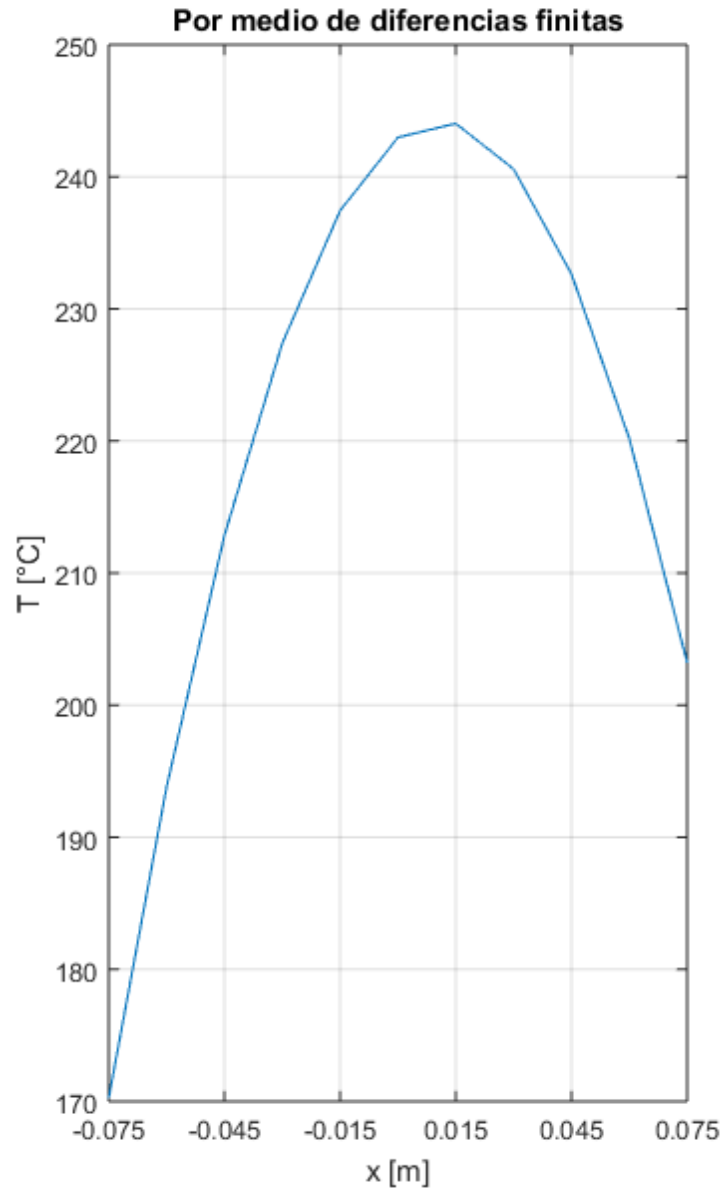
Tipo de falla: N/A

Resolver

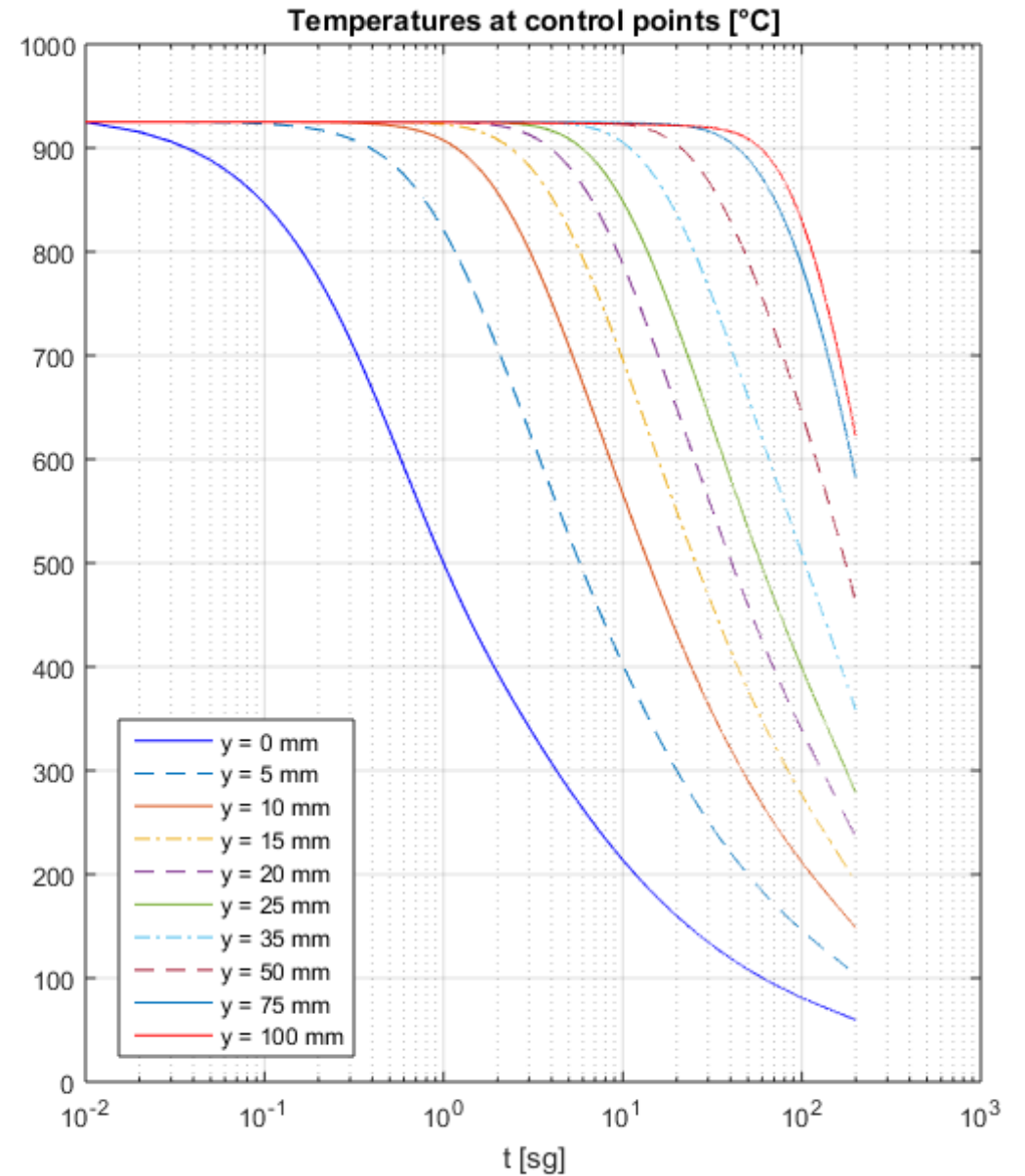
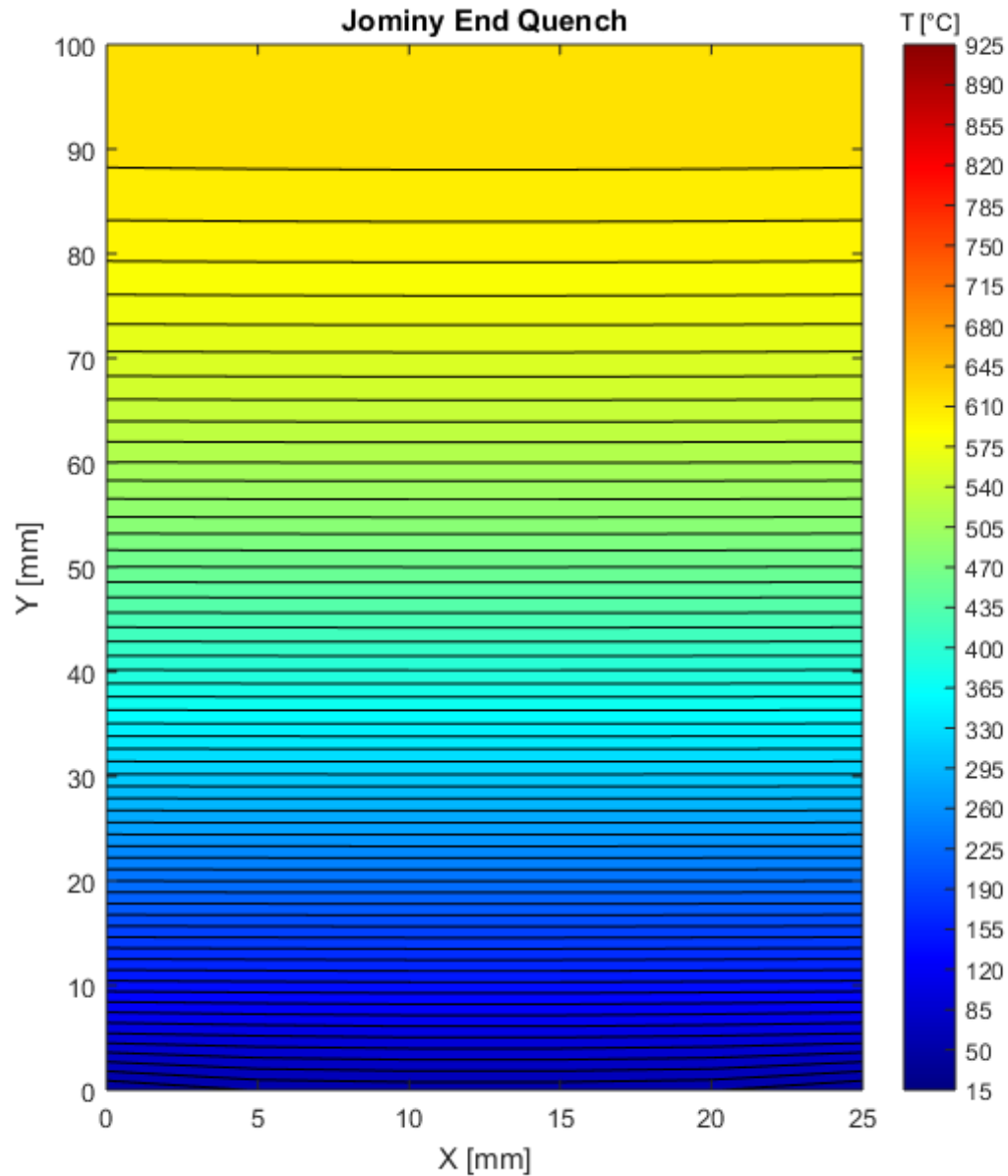




Mechanical Engineering



Mechanical Engineering



Mechanical Engineering

FIN_DESIGN_GUI

Heat Sink Optimization

Boundary Conditions

Temperature at base [K]

473

Fluid Temperature [K]

298

Fluid Convection Coefficient [W/mK]

50

Design Goals

Budget [USD]

1

Heat Transfer Rate [W]

150

Materials

File Name :

materials.csv

Load

Design Constrains

Base Width [m]	Base Height [m]	Min. fin pitch [m]
0.1	0.05	4e-3
	Min	Max
Number of Fins	1	5
Fin Length [m]	1e-3	0.1
Fin Thickness [m]	5e-3	0.05
Fin Width [m]	1e-3	0.05

Log

BEST PARAMETERS:

No. of fins: 5

$w = 47.415246$ [mm]

$t = 5.000000$ [mm]

$l = 30.420461$ [mm]

Fin type: Triangular profile

Material: Al-2024-T6

Qt: 153.822612 [W]

$V: 1.802992e-05$ [m³]

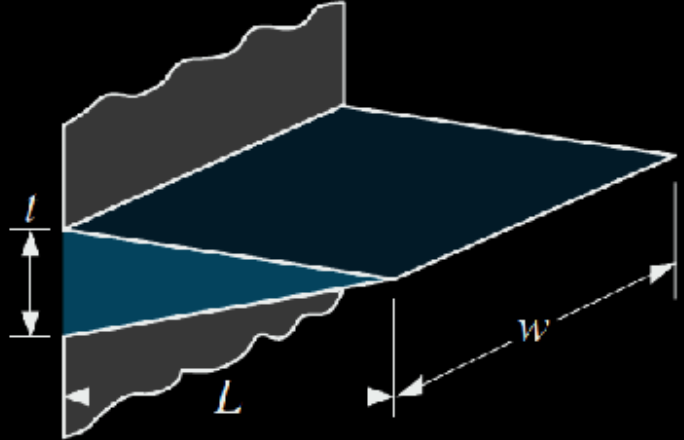
Cost: 9.988576e-01

CHECK

GO!

Results Visualization

OPTIMAL FIN GEOMETRY



The diagram shows a 3D perspective of a triangular fin. The base width is labeled W , the fin length is labeled L , and the fin thickness is labeled l . The fin is shown in a dark blue color, and the base is in a lighter blue color.

Number of fins:

5

Maximum distance between fins [mm]:


6.25

Heat Sink Optimization Software v.1.0 // Authors: Lino Mediavilla & Javier Miranda // Contact: lino.mediavilla@estud.usfq.edu.ec ; javier.miranda@estud.usfq.edu.ec // All Rights Reserved (c) 2017

CAN WE CODE ALREADY?


Vector & Matrix operations

Dot product

$$\begin{array}{cc} \mathbf{u} & * & \mathbf{v} \\ 1 \times n & & n \times 1 \end{array}$$



*Inner dims
consistent*

Vector-by-Matrix

$$\begin{array}{cc} \mathbf{v} & * & \mathbf{M} \\ 1 \times n & & n \times m \end{array}$$


*Inner dims
consistent*

Matrix-by-Matrix

$$\begin{array}{cc} \mathbf{A} & * & \mathbf{B} \\ m \times n & & n \times p \end{array}$$


*Inner dims
consistent*

Linear eqn. system

$$\mathbf{Ax} = \mathbf{b}$$

$$2x_1 + 9x_2 = 5$$

$$3x_1 - 4x_2 = 7$$

$$\begin{bmatrix} 2 & 9 \\ 3 & -4 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} = \begin{bmatrix} 5 \\ 7 \end{bmatrix}$$

Matrix indexing exercises

A =

1	7	8	4
6	4	3	7
2	5	9	3
8	3	2	1

B =

9	3	7	5
4	1	2	8
6	2	7	4
1	0	3	2


- **Calculate** the **dot product** of the *first row* of A and the *last row* of B
- **Multiply** every **even** row of A by 10
- **Create** a new matrix C by **adding** the **red submatrices**
- **Set** all the 'edges' of B to 0
- **Replace** the **blue submatrix** of A with the **green submatrix** of B

Cell Arrays: more flexible data structures

- How do we store this data?

<i>Day</i>	<i>T_{air}</i>	<i>T_{water}</i>
1	(60 72 65)	$\begin{pmatrix} 55 & 57 & 56 \\ 54 & 56 & 55 \\ 52 & 55 & 53 \end{pmatrix}$
2	(63 74 66)	$\begin{pmatrix} 56 & 58 & 58 \\ 55 & 59 & 57 \\ 54 & 57 & 55 \end{pmatrix}$

Structs: even more flexibility!

- student1: 
 - name: 'Geovanny Espinel'
 - scores: [3.7, 3.5, 3.8, 3.9, 4.0]
 - fac: 'IIN'
- students: { student1, student2, ... }