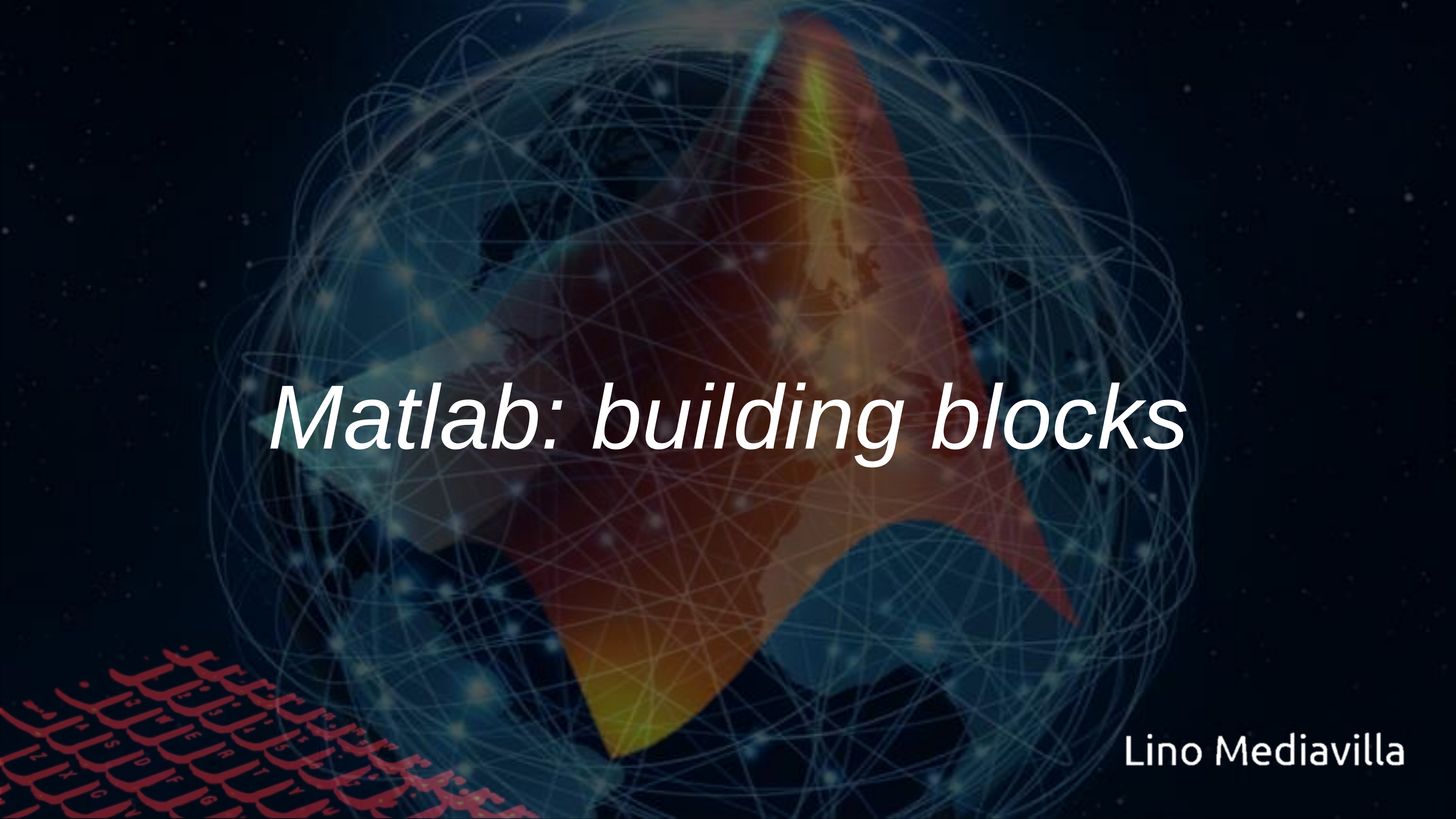


Matlab: building blocks

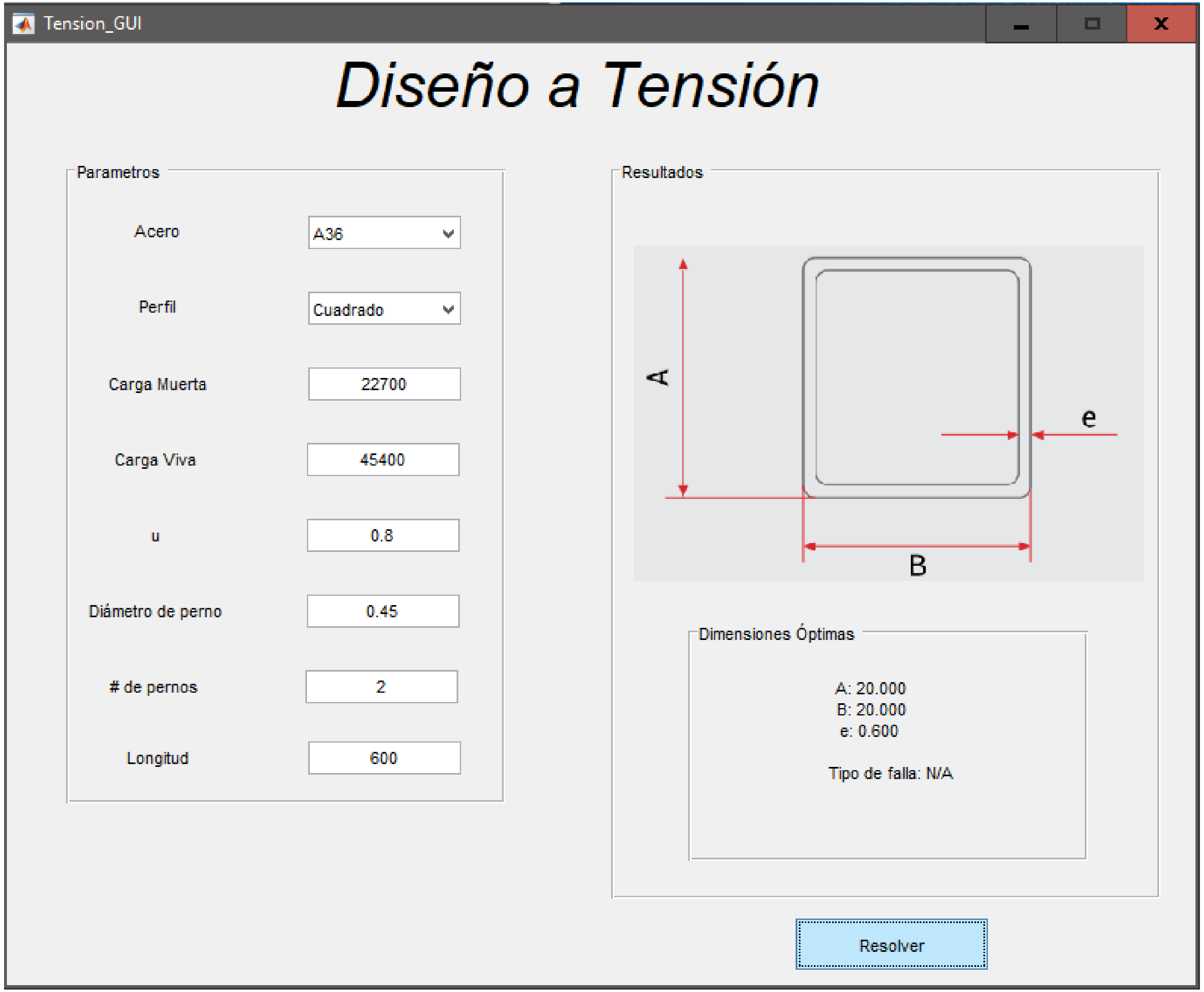
Lino Mediavilla

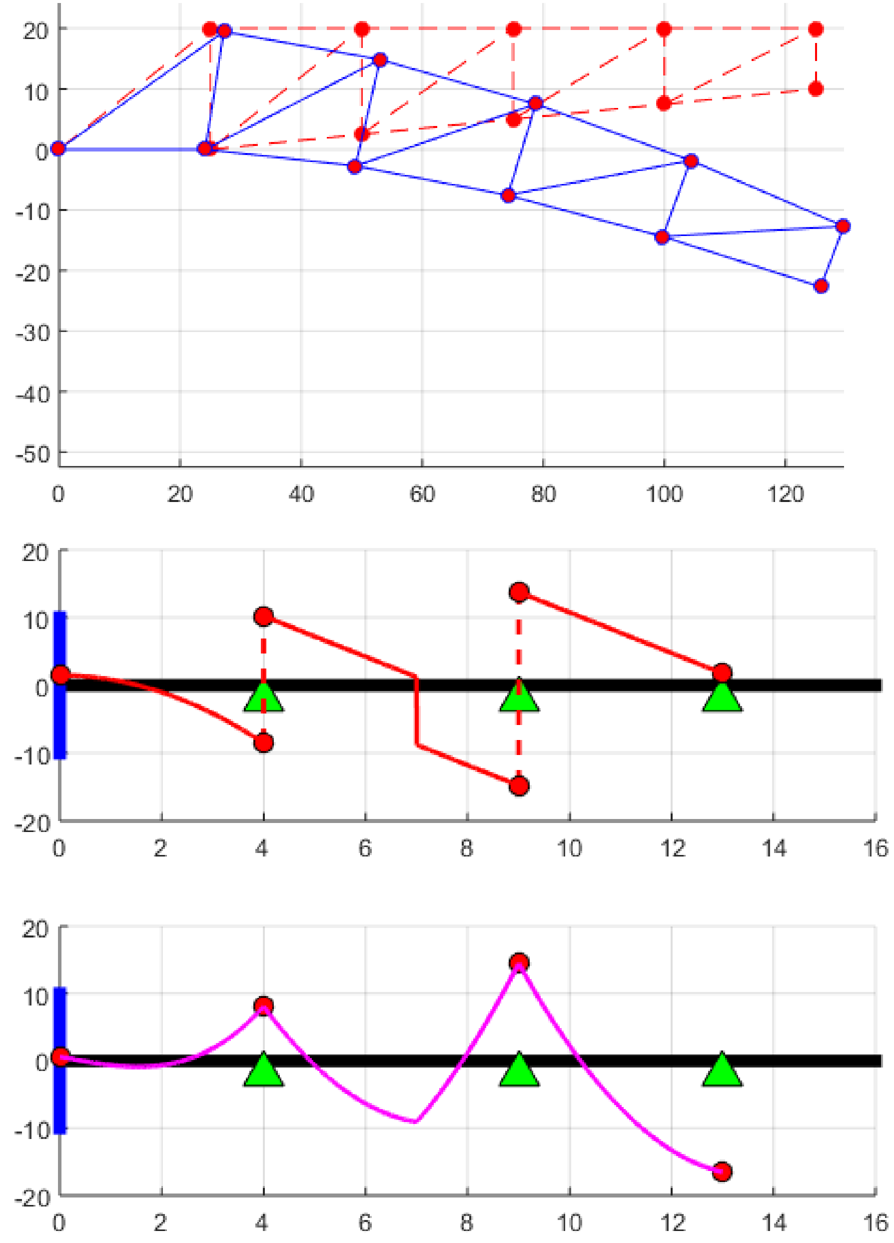
What is Matlab?

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

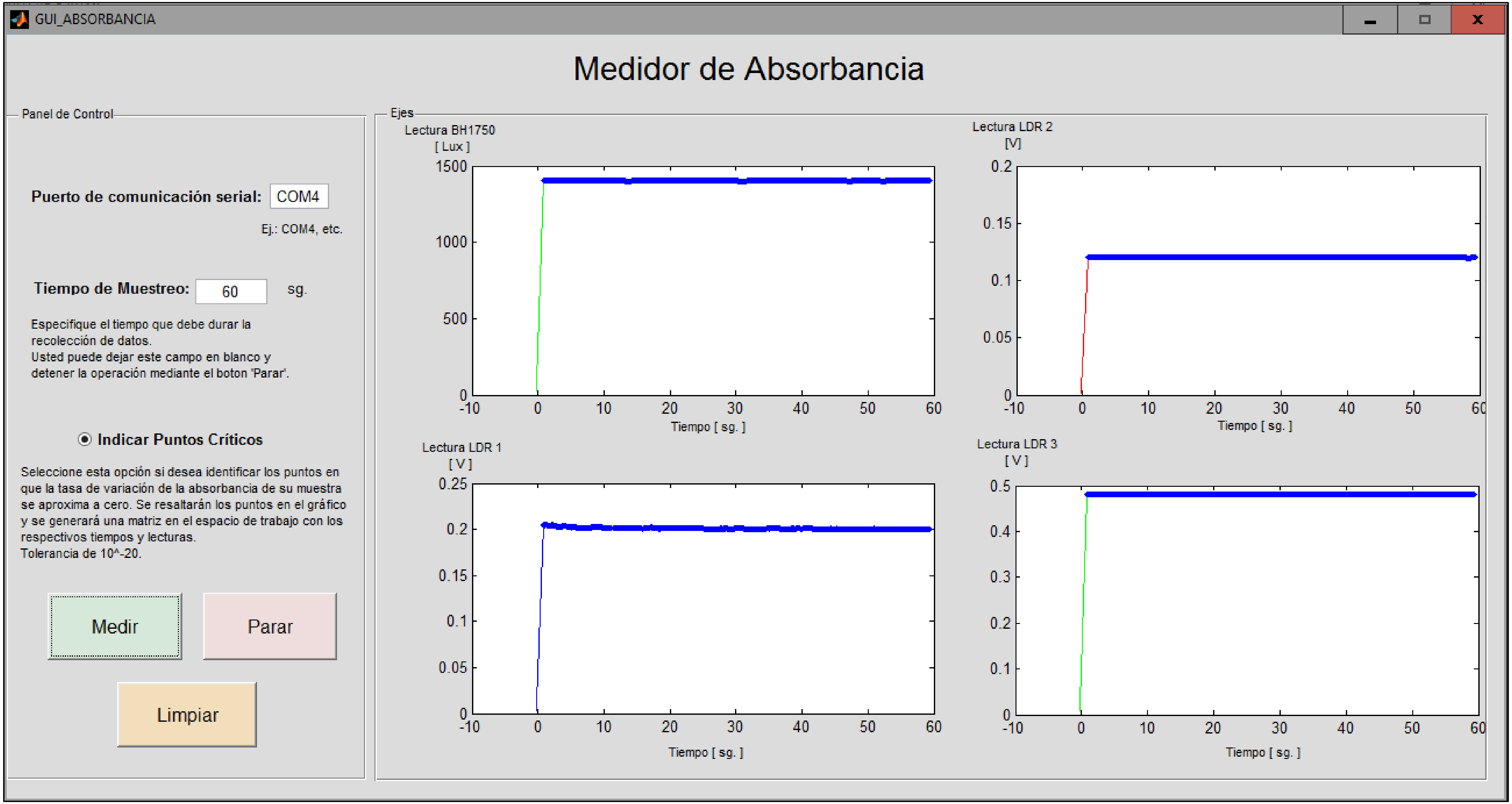
```
>> M = [1 6 7; 3 2 5; 6 9 0]

M =

     1     6     7
     3     2     5
     6     9     0

>> M(1,3)

ans =

     7
```

Civil Engineering

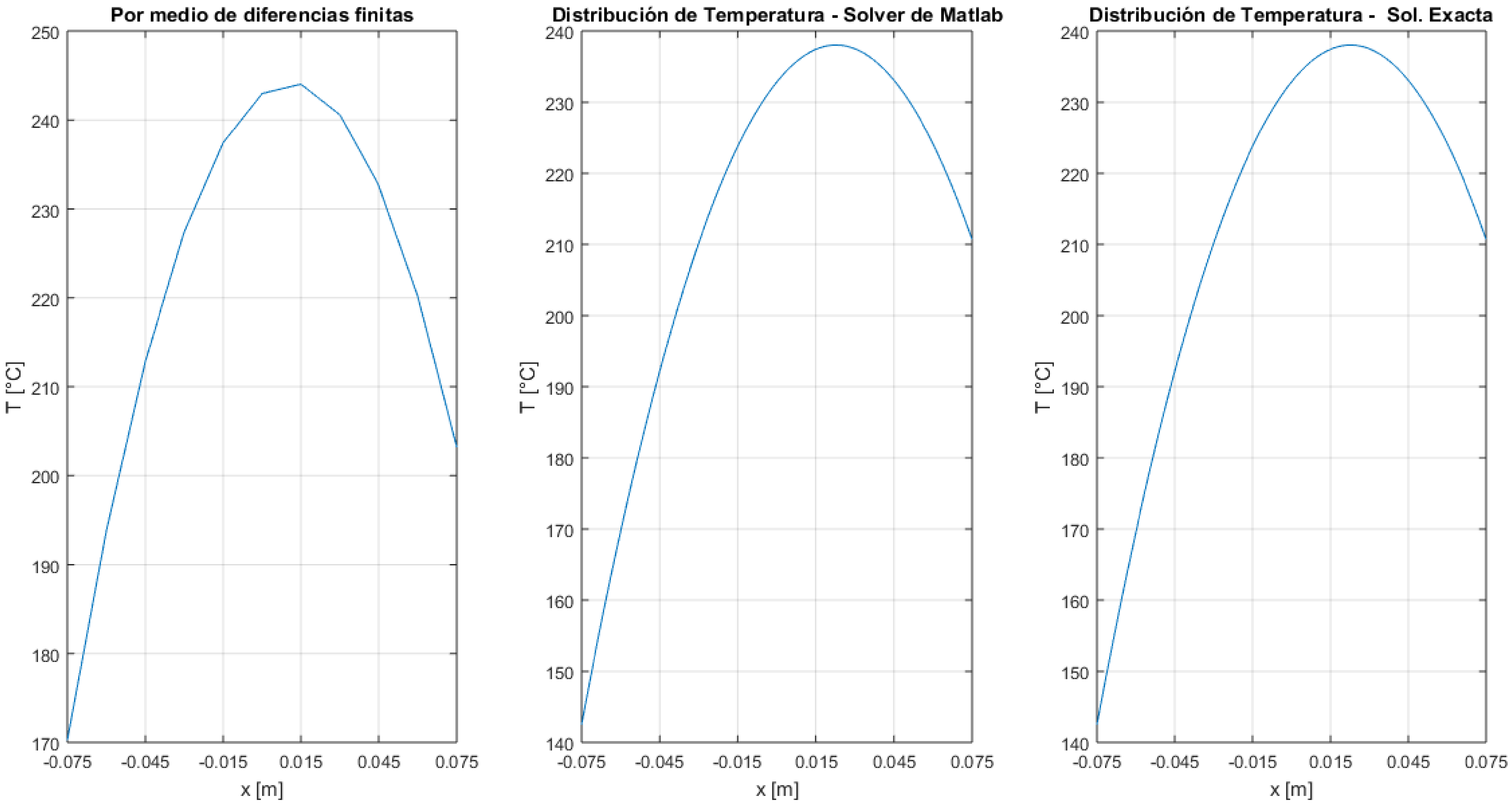




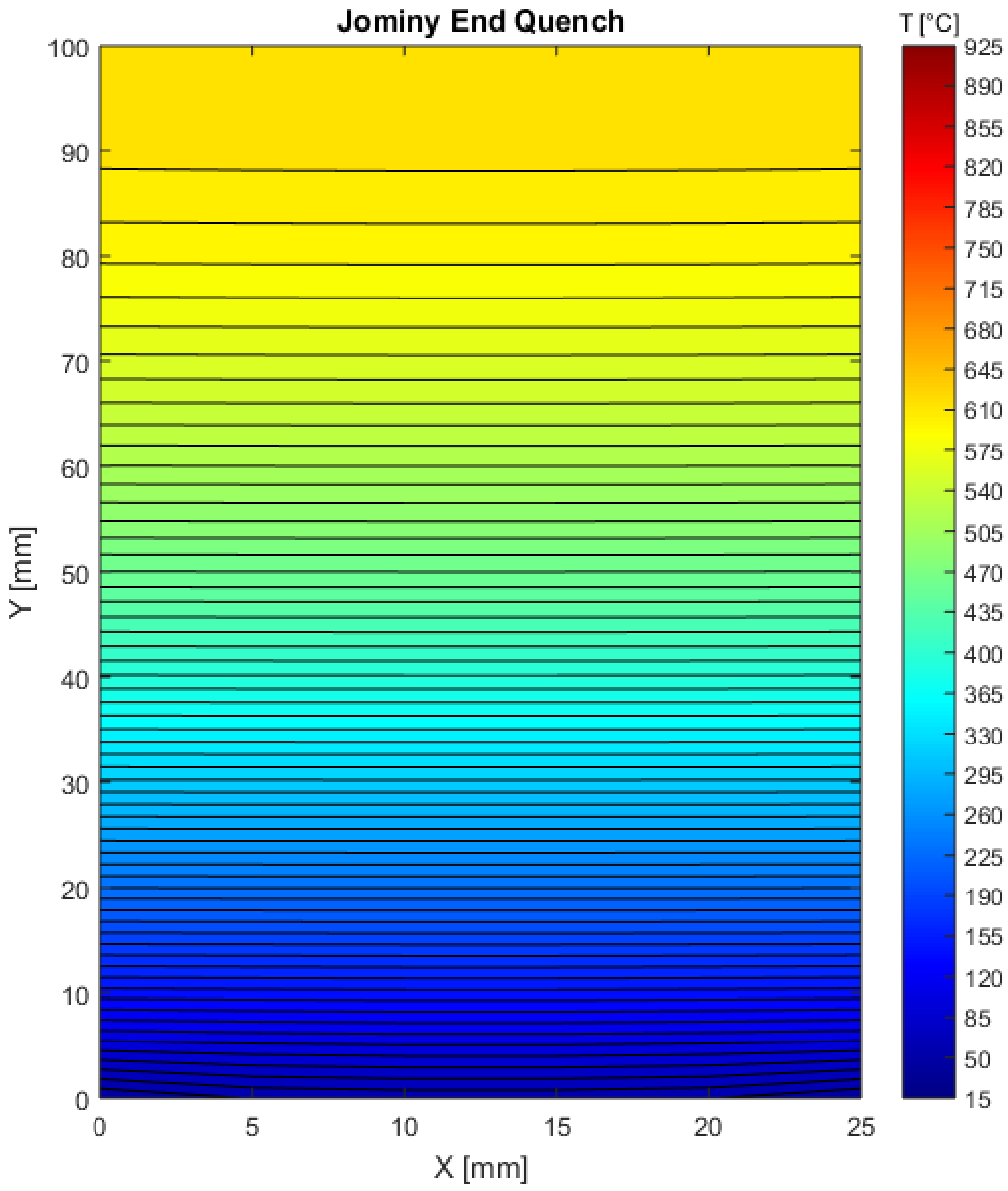
Electronics

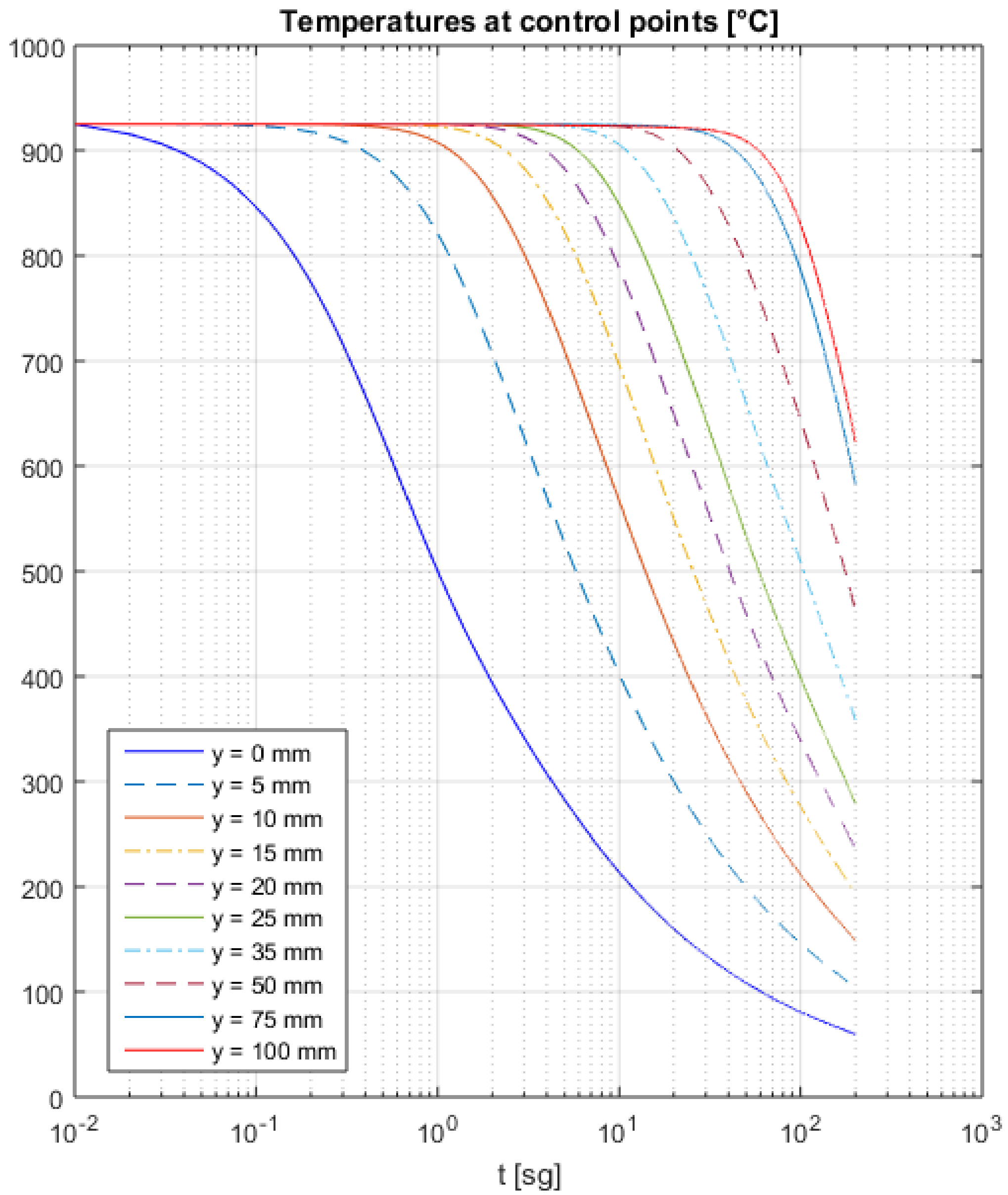


Mechanical Engineering

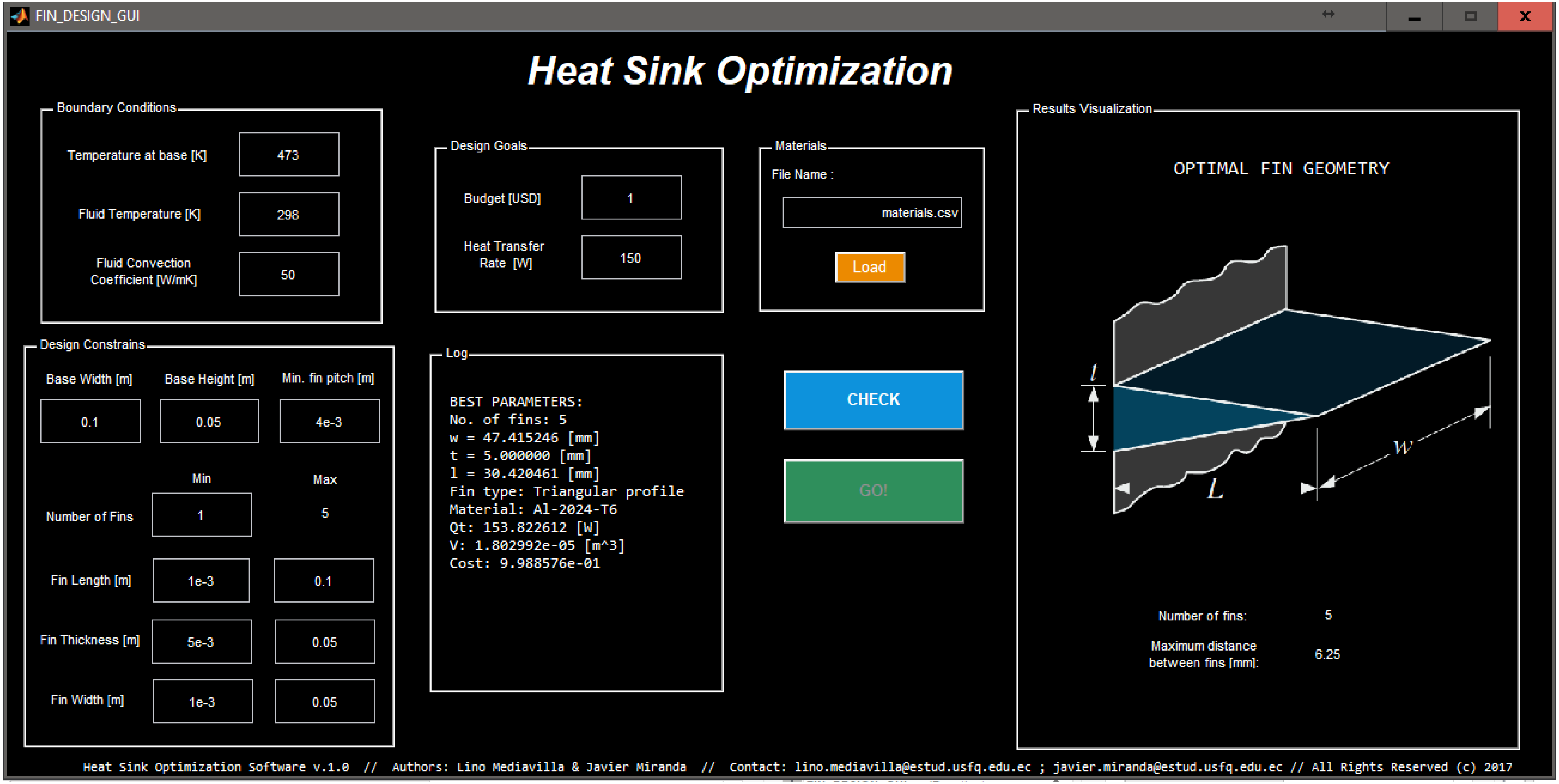


Mechanical Engineering





Mechanical Engineering



CAN WE CODE ALREADY?

Vector & Matrix operations

Dot product	Vector-by-Matrix	Matrix-by-Matrix
u * **v**	**v** * **M**	**A** * **B**
1xn nx1	1xn nxm	mxn nxp
Inner dims consistent	*Inner dims consistent*	*Inner dims consistent*

Linear eqn. system

$$\mathbf{A}\mathbf{x} = \mathbf{b}$$

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

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

Matrix indexing exercises

A =

$$\begin{matrix} 1 & 7 & 8 & 4 \\ 6 & 4 & 3 & 7 \\ 2 & 5 & 9 & 3 \\ 8 & 3 & 2 & 1 \end{matrix}$$

B =

$$\begin{matrix} 9 & 3 & 7 & 5 \\ 4 & 1 & 2 & 8 \\ 6 & 2 & 7 & 4 \\ 1 & 0 & 3 & 2 \end{matrix}$$

- **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?

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

Structs: even more flexibility!

- student1:

  name: ‘Geovanny Espinel’

  scores: [3.7, 3.5, 3.8, 3.9, 4.0]

  fac: ‘IIN’

- students: { student1, student2, … }