(Thesis 1) SIMULATIONS AND IMPLEMENTATION OF MAGNETIC MICROGRIPPERS FOR THE REMOVAL OF TEXTILE DYES IN WASTEWATERS

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Introduction

- **W**ater as an essential component to perform all human activities is a vital constituent of living organisms. However, the continued urbanization and population has had a high impact in the environmental development, diminishing potable water supplies and polluting oceans, aquifers, rivers, lakes, and groundwater at an unprecedented rate [1][2][3]. Some of the most common pollutants include pathogens, excess nutrients, suspended solids, sediments, pesticides, plastics, fertilizers, acids, detergents, phenols, minerals, and heavy metals which are discharged from homes, businesses, industry, cities, agriculture and the one we are focusing on this project is textile inks. [4][5][6].

OBJECTIVES AND SCOPE

Simulation and implementation of biomicromechanical devices for the removal of textile dyes from wastewaters.

Specific (Tesis 1)

- Select materials and appropriate surface functionalization strategies to conduct textile dyes removal processes from wastewaters.

- Engineer the geometry and simulate selected materials with suitable capacity to be implemented in the microstructures.

- Use software to simulate magnetic and mechanical responses of the microstructures and interactions among themselves.

Methodology

Three different simulations for each material tested.

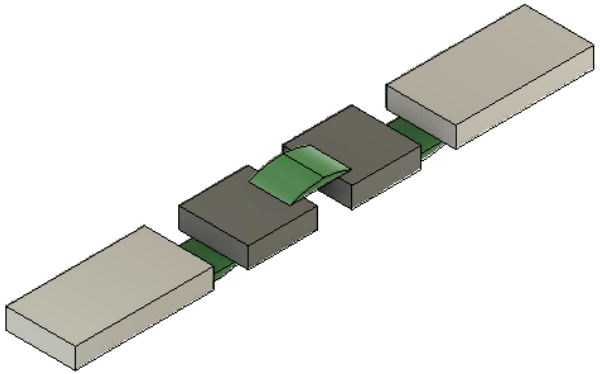
- One for simple interaction of the gripper and natural magnetic behavior
- One for study the behavior of a gripper with changes like magnetic field, temperature, among others.
- One for the study of interactions between two or more grippers.

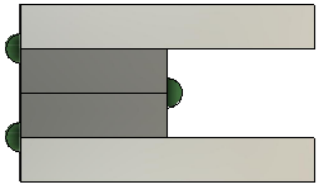
Report of materials behavior and viability for real-life implementation

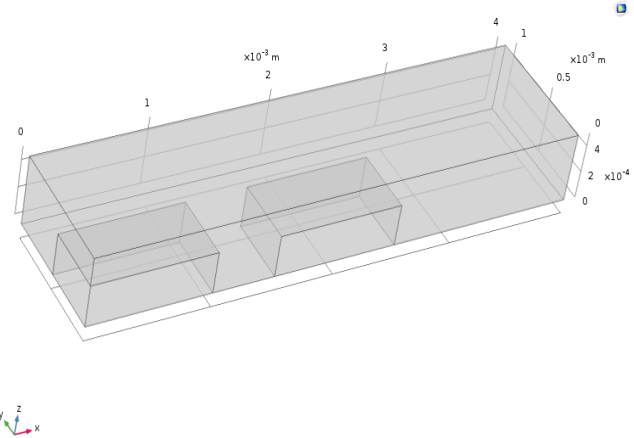
One final selected material with all simulations and characterization.

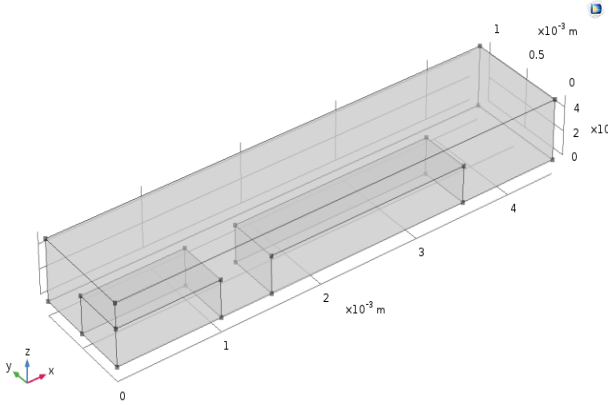
Optimal geometry chosen for the implementation of micro gripper. Thickness of the multilayer and material description.

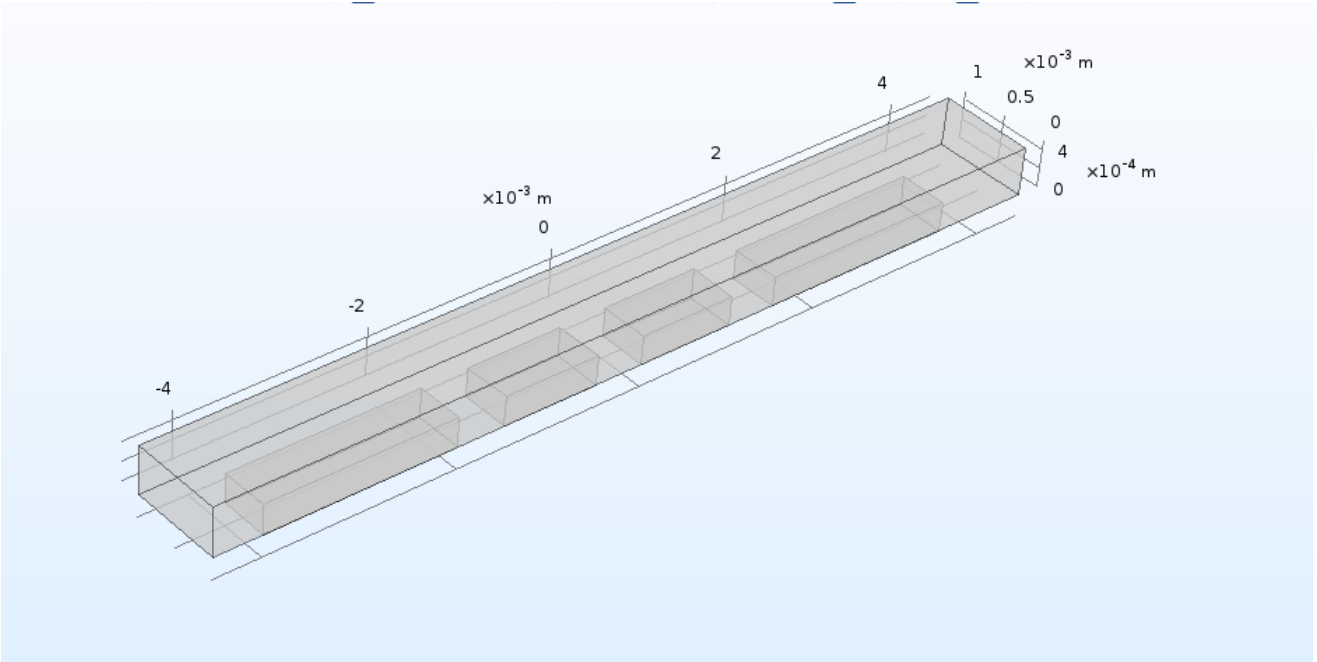
Inicial draft



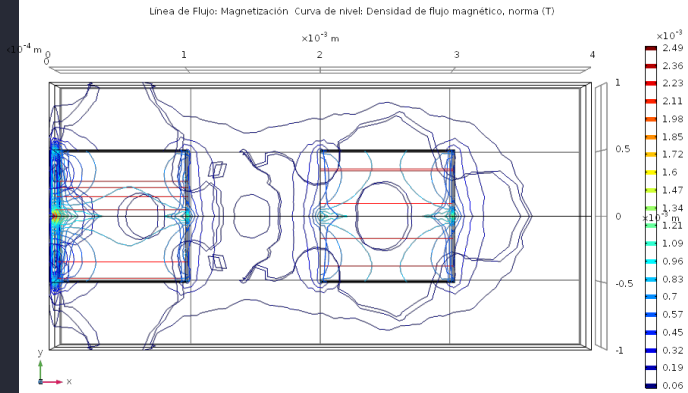


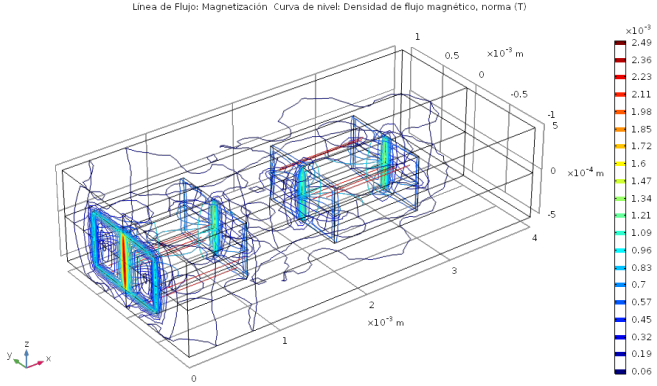


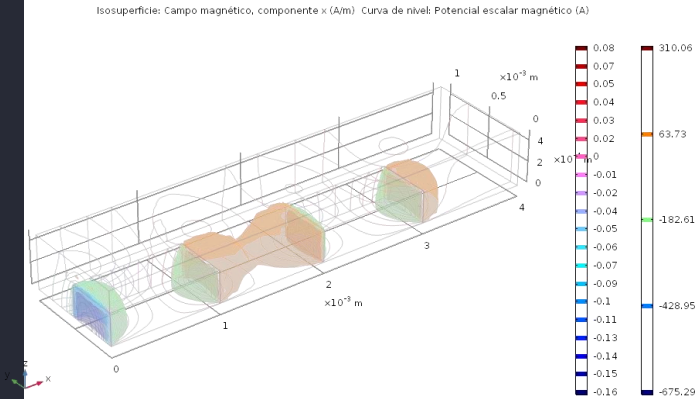


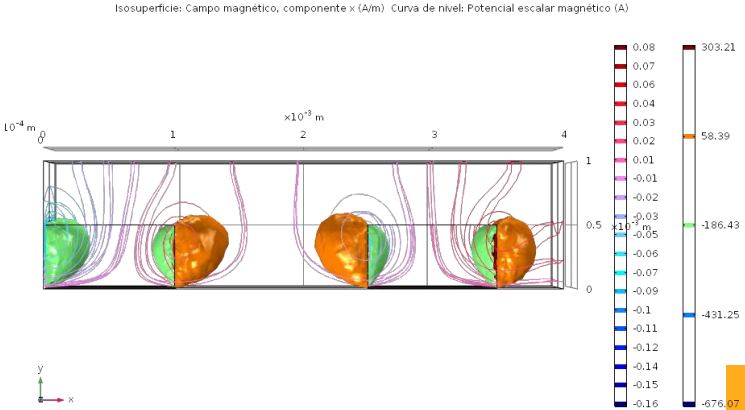

×10-3 m
4
2
0
-2
-4
×10-3 m
1
0.5
0
×10-4 m
4
0

Magnet - Magnet

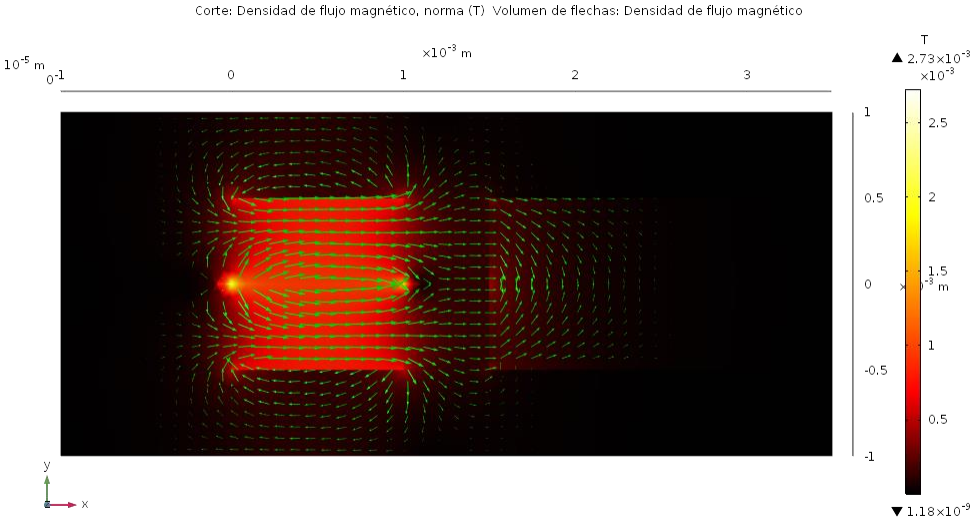


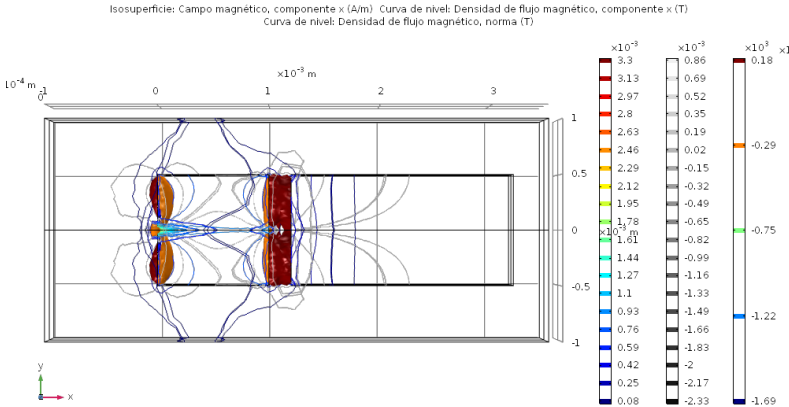


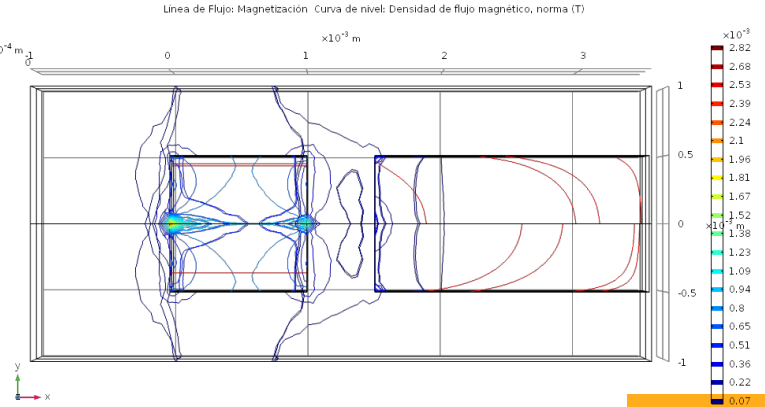


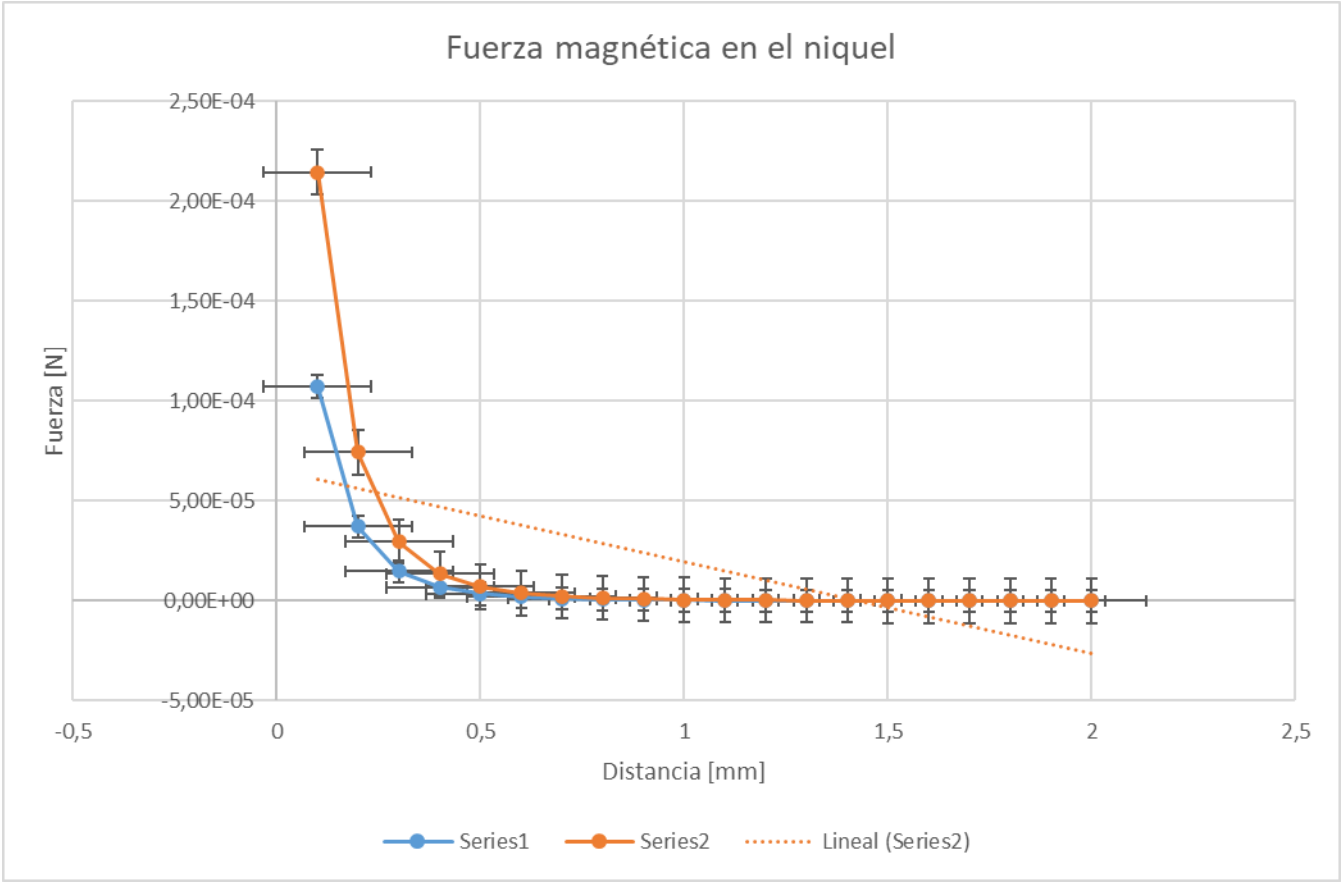


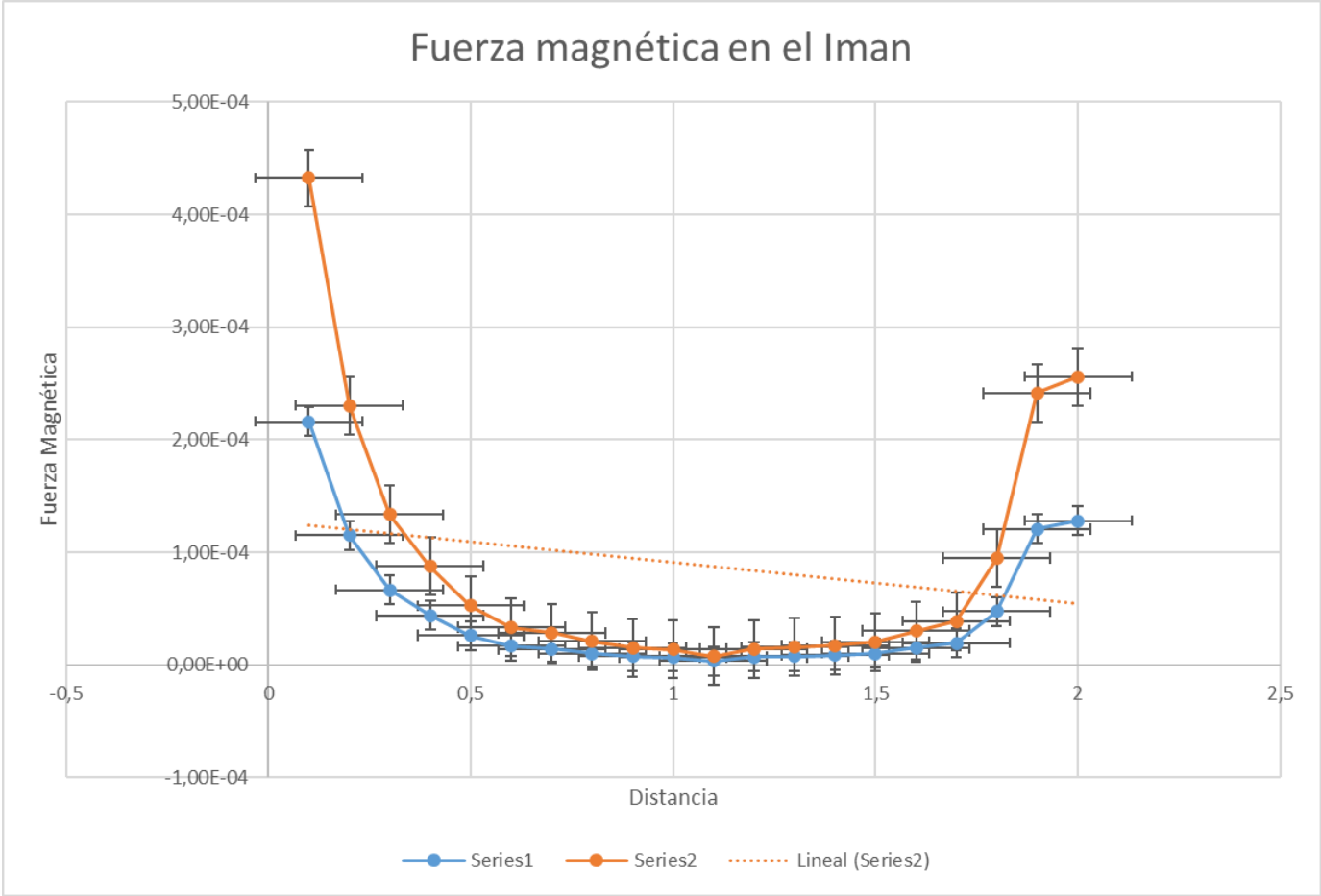
Magnet - Niquel

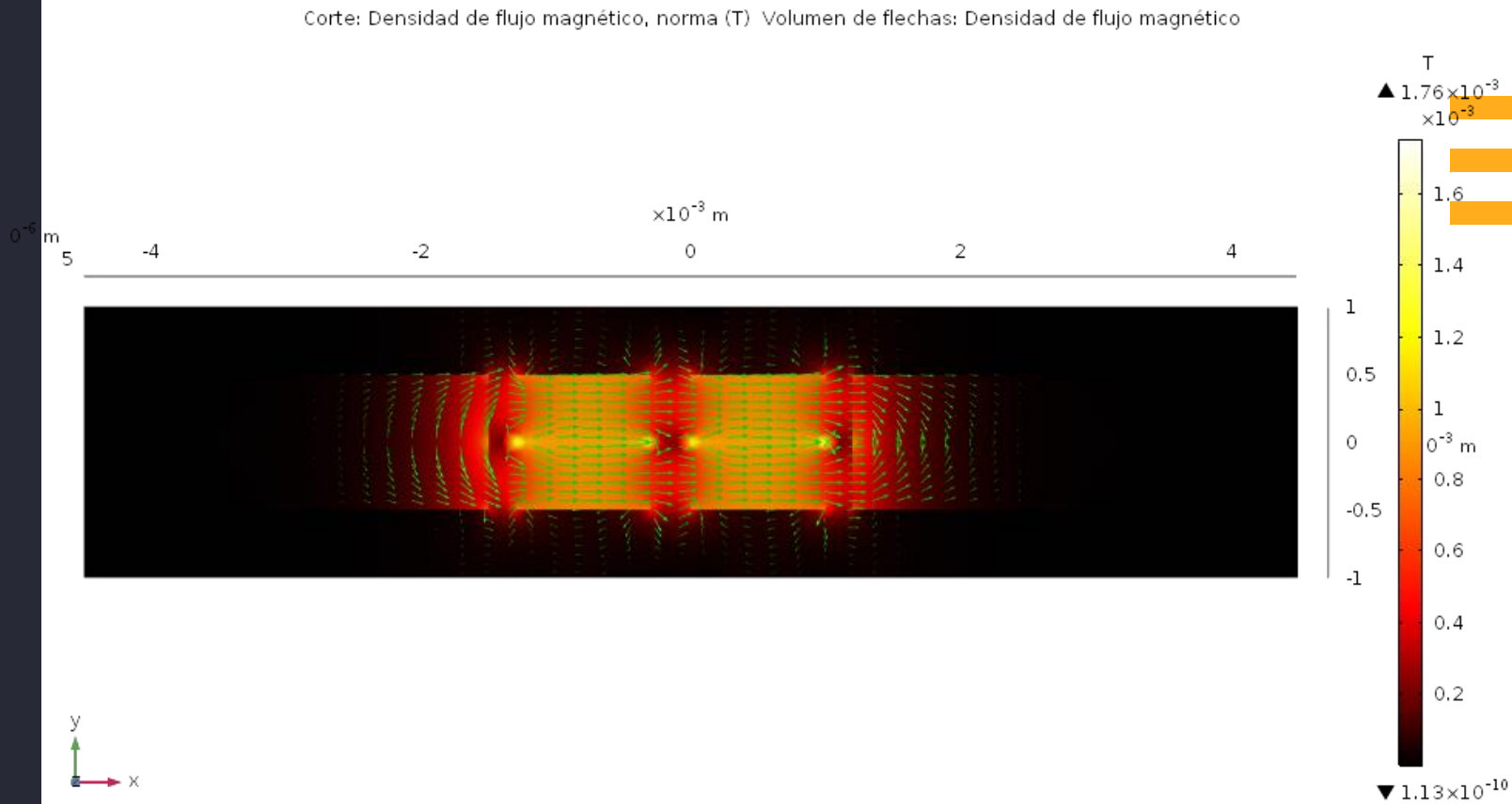


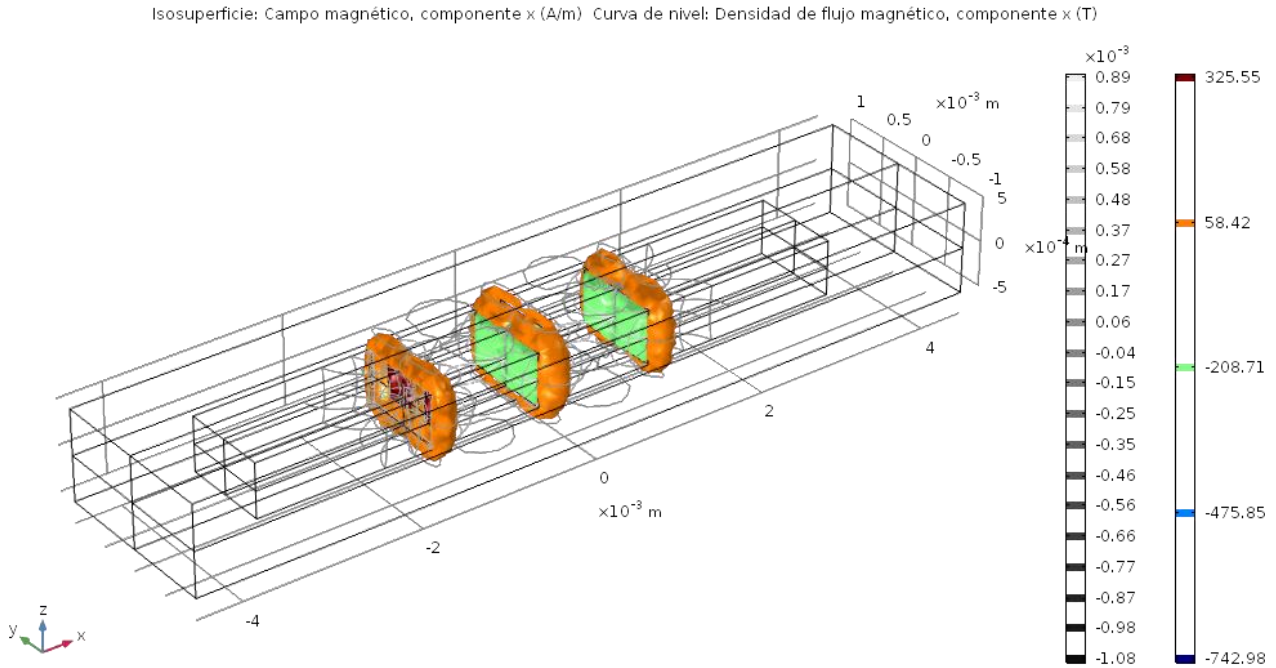


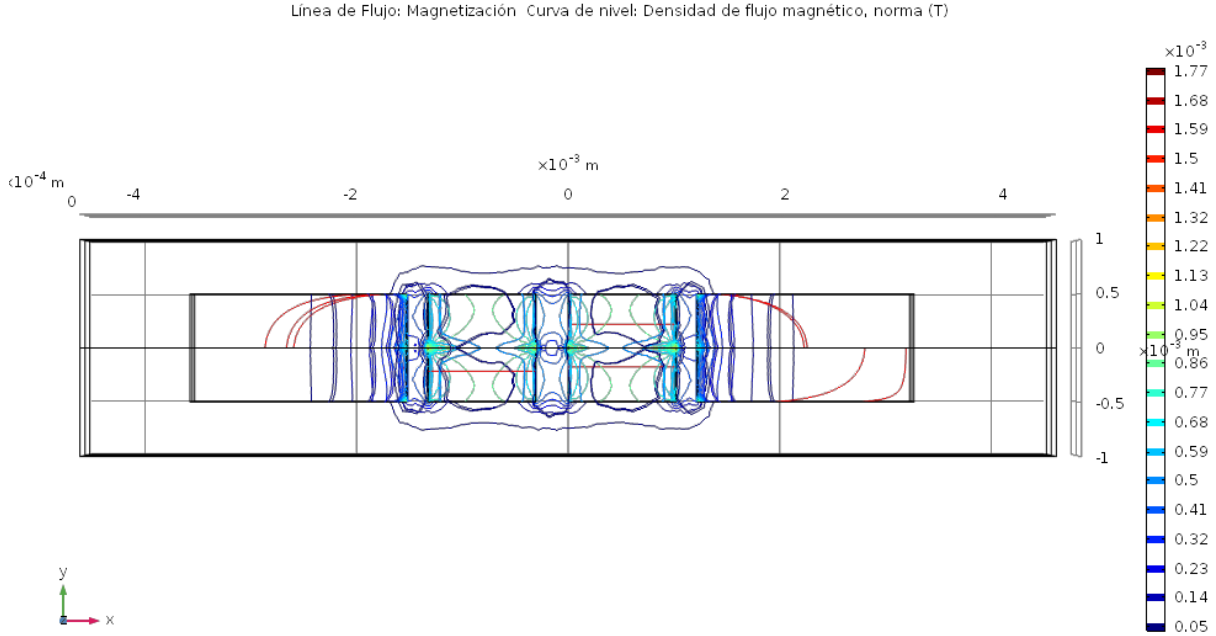


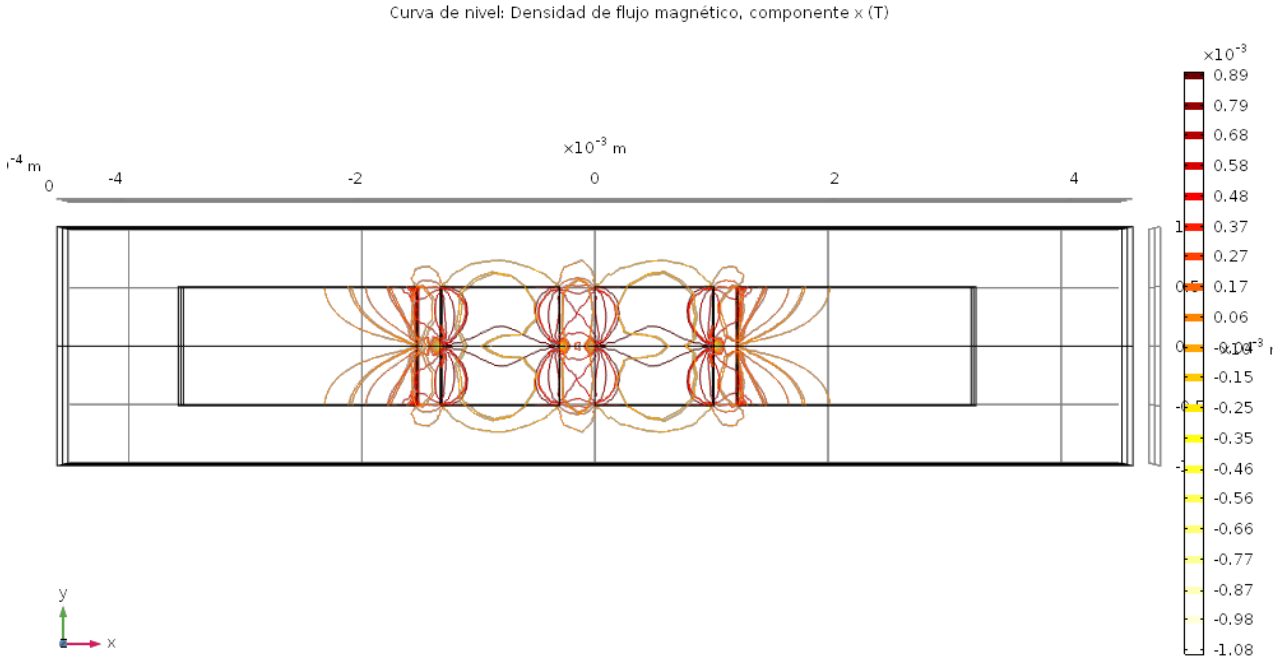

Fuerza magnética en el niquel
2,50E-04
2,00E-04
1,50E-04
1,00E-04
5,00E-05
0,00E+00
-5,00E-05
Fuerza [N]
-0,5
0
0,5
1
1,5
2
2,5
Distancia [mm]
Series1
Series2
Lineal (Series2)


Fuerza magnética en el Iman
5,00E-04
4,00E-04
3,00E-04
2,00E-04
1,00E-04
0,00E+00
-1,00E-04
Fuerza Magnética
-0,5
0
0,5
1
1,5
2
2,5
Distancia
Series1
Series2
Lineal (Series2)

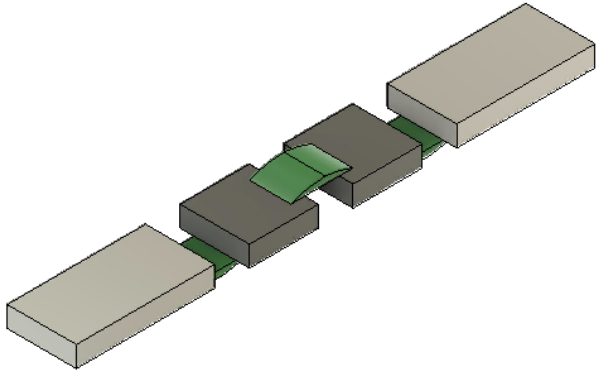

Corte: Densidad de flujo magnético, norma (T) Volumen de flechas: Densidad de flujo magnético
T
▲ 1.76×10^-3
×10^-3
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0^-3 m
▼ 1.13×10^-10
×10^-3 m
-4
-2
0
2
4
0^-6 m
5
1
0.5
0
-0.5
-1
y
x

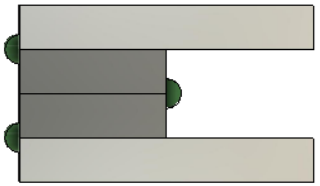

Isosuperficie: Campo magnético, componente x (A/m) Curva de nivel: Densidad de flujo magnético, componente x (T)
×10⁻³ m
1
0.5
0
-0.5
-1
5
0
-5
×10⁻⁴ m
4
2
0
-2
-4
×10⁻³ m
z
y
x
×10⁻³
0.89
0.79
0.68
0.58
0.48
0.37
0.27
0.17
0.06
-0.04
-0.15
-0.25
-0.35
-0.46
-0.56
-0.66
-0.77
-0.87
-0.98
-1.08
325.55
58.42
-208.71
-475.85
-742.98

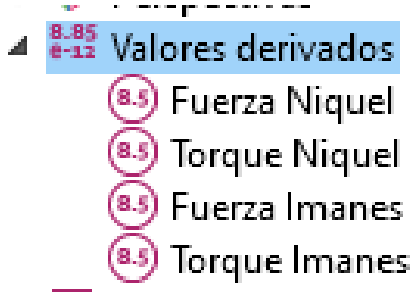

Línea de Flujo: Magnetización Curva de nivel: Densidad de flujo magnético, norma (T)
×10^-4 m
0
×10^-3 m
-4
-2
0
2
4
1
0.5
0
-0.5
-1
×10^-3
1.77
1.68
1.59
1.5
1.41
1.32
1.22
1.13
1.04
0.95
×10^-3 m
0.86
0.77
0.68
0.59
0.5
0.41
0.32
0.23
0.14
0.05
y
x


Curva de nivel: Densidad de flujo magnético, componente x (T)
×10^-3 m
-4
-2
0
2
4
×10^-3
0.89
0.79
0.68
0.58
0.48
0.37
0.27
0.17
0.06
-0.04
-0.15
-0.25
-0.35
-0.46
-0.56
-0.66
-0.77
-0.87
-0.98
-1.08
y
x

Future Work






8.85 e-12
Valores derivados
8.5
Fuerza Niquel
8.5
Torque Niquel
8.5
Fuerza Imanes
8.5
Torque Imanes

Thanks!

Any questions?