

# Electromagnetic Virtual Playground

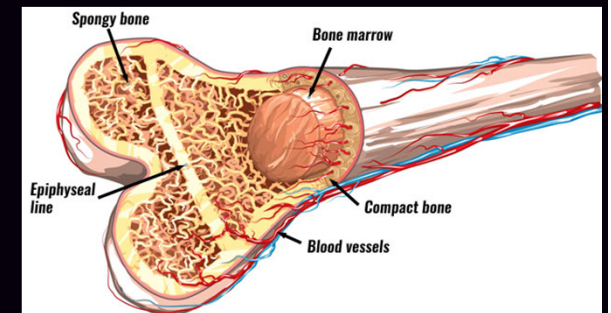
**Members:** Chisom Atulomah, Marvin Atwell, Andrew Awoniyi,  
Kyle Simon

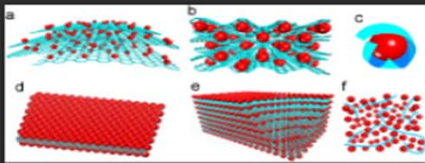
**Faculty Advisor:** Dr. Su Yan, Ph.D.

**Date:** April 14th, 2023

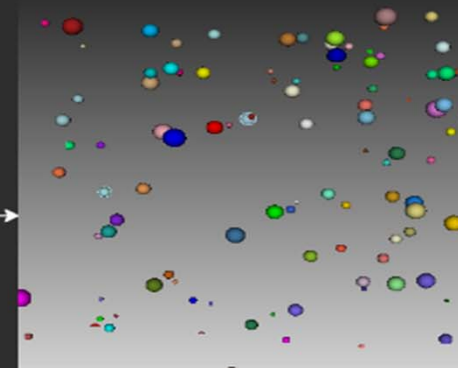
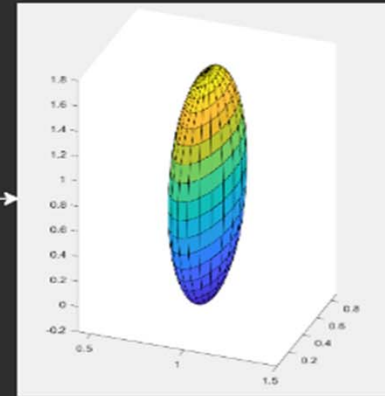
# Background

- Mixing of two or more different materials of various physical properties will create a composite material.
- Homogenization and evaluation of RC material's macroscopic EM properties
- Establishment of physical/mathematical models for simulation





Distribution



Simulation of materials requires large-scale generation of finite elements

# Problem Statement

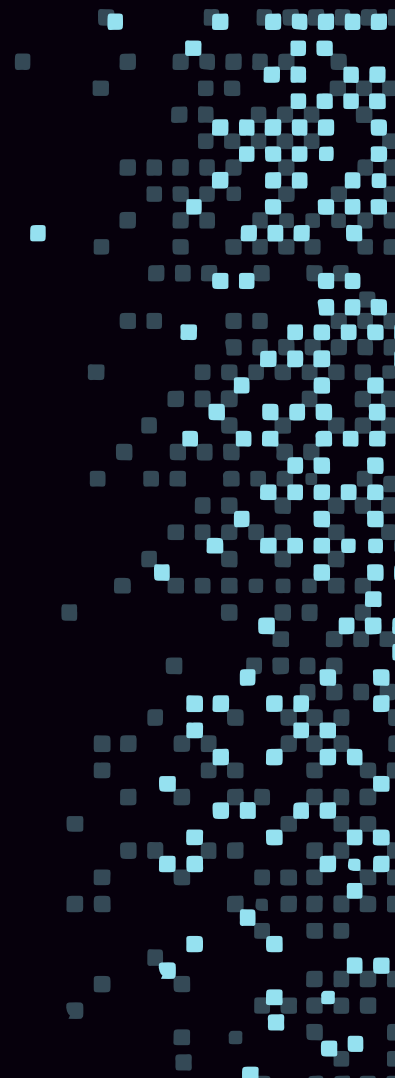
- This project aims to create a tool that aids in the development of a simulation model for electromagnetic (EM) waves within a randomly distributed composite material.
- This will be done through the finite element method (FEM), which involves the large-scale generation of 3D objects within a subdomain model.

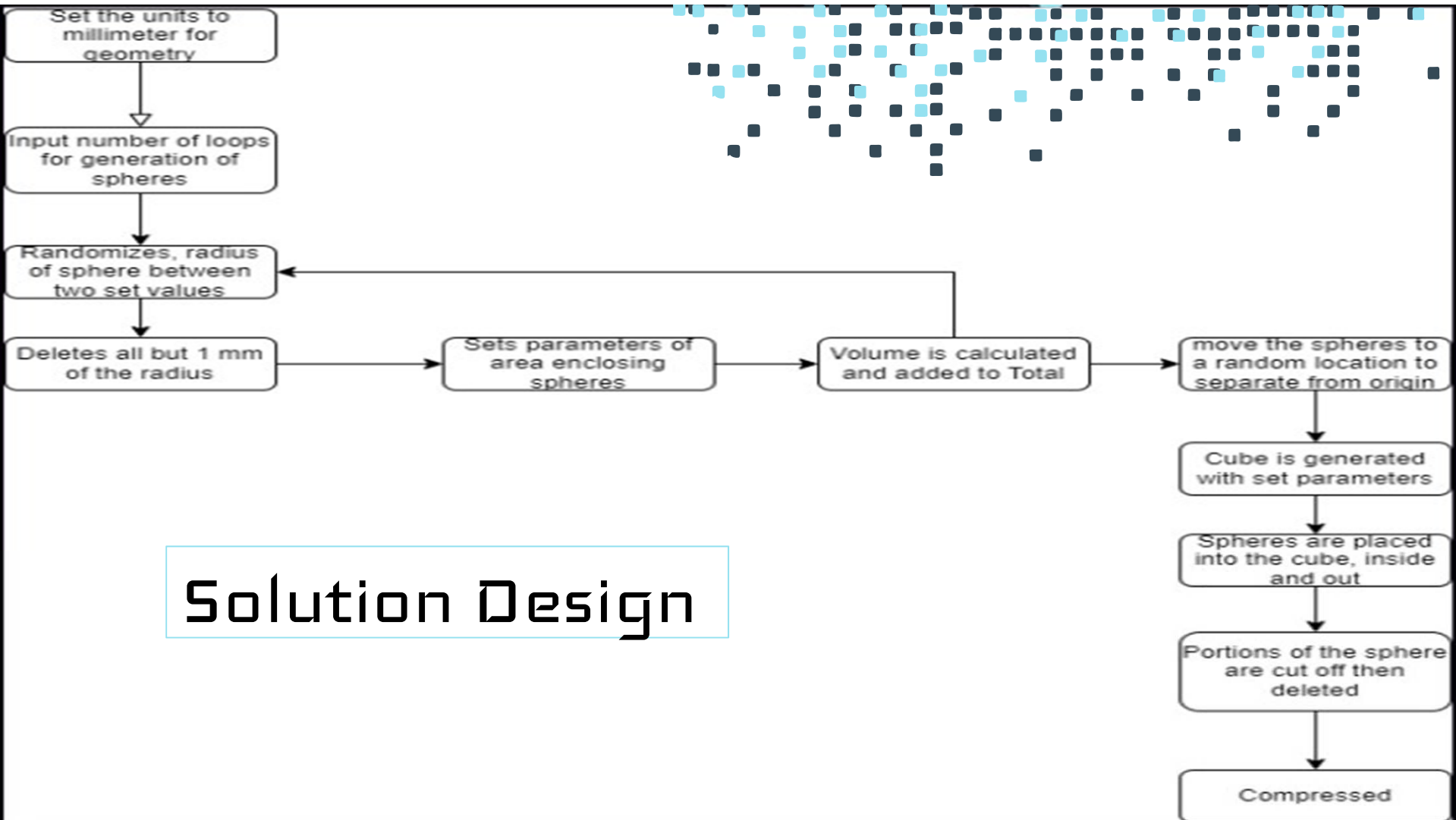
# Design Requirements

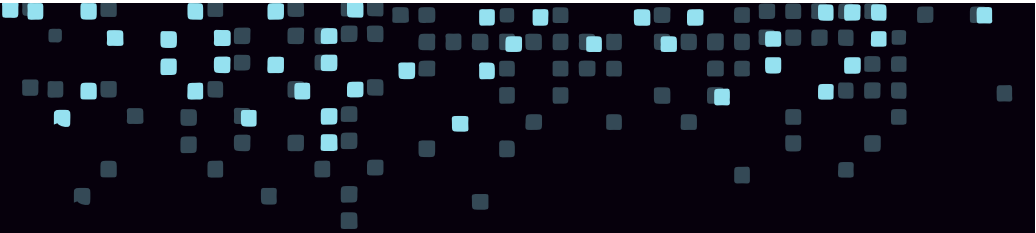
## Constraints:

- **Compliance:** The tool should be used for educational purposes only. Commercial or malicious use is not allowed.
- **Socio-Cultural:** The USERS may not be accustomed with the software being used to simulate the program.
- **Environmental:** N/A

\* Project demonstrated with the help of TRELIS 16.1.



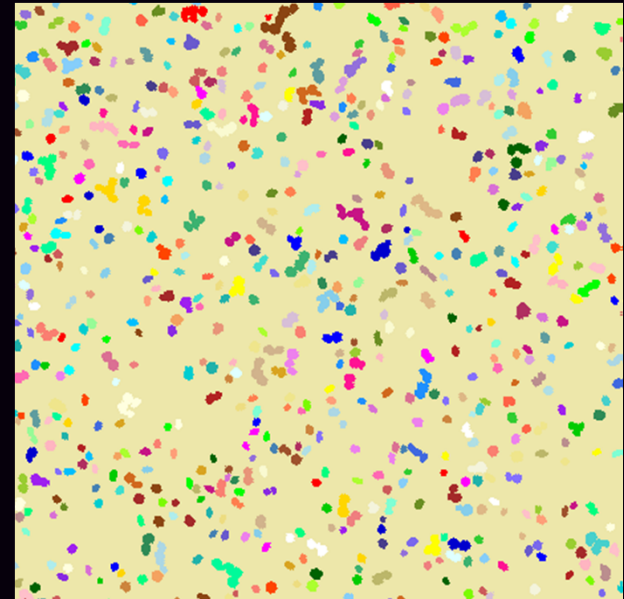
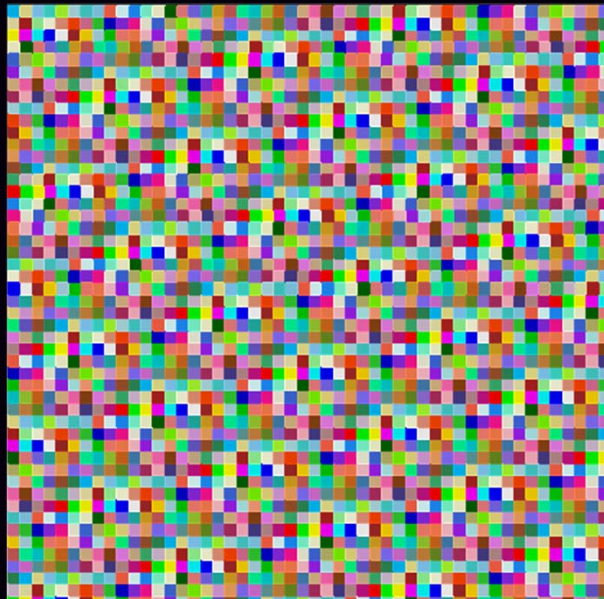




# SPRINT DEVELOPMENT

# Implementation Process: SPRINT I

SPRINT 1	CODE TO GENERATE RANDOMIZED CIRCLES	SIMULATION AND RECONSTRUCTION OF RANDOMIZED 2 DIMENSIONAL CHECKERBOARD CODE IN TRELIS 16.1	ADVANCEMENT FROM RANDOMIZED 2 DIMENSIONAL CHECKERBOARD TO RANDOMIZED CIRCLES
-------------	----------------------------------------	--------------------------------------------------------------------------------------------------	------------------------------------------------------------------------------------

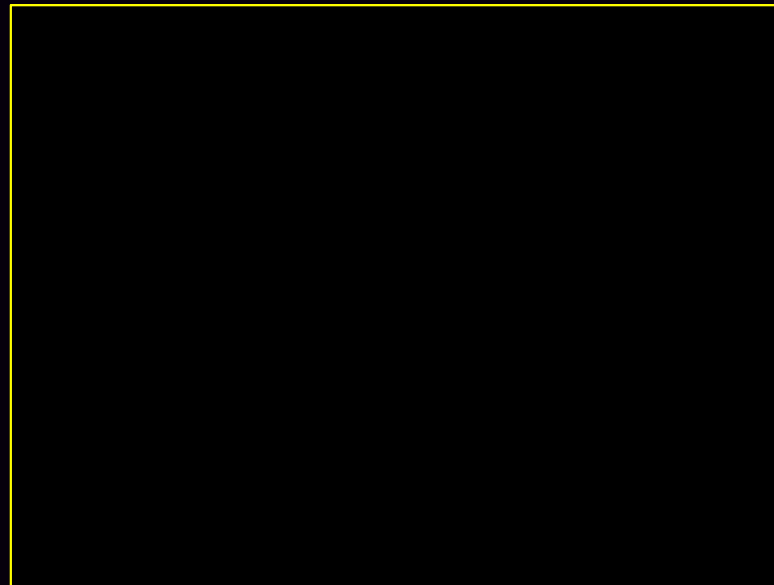


# Implementation

## Process: SPRINT II

SPRINT 2	FINALIZED CODE GENERATING RANDOMIZED SPHERE MODEL	ADVANCEMENT FROM RANDOMIZED CIRCLES TO RANDOMIZED SPHERES	GENERATE MODEL MESH
-------------	------------------------------------------------------	--------------------------------------------------------------	---------------------

PT 1



# Implementation

## Process: SPRINT III

SPRINT 3	CALCULATE TOTAL VOLUME TO PREDICT ELECTROMAGNETIC BEHAVIOUR	CALCULATE VOLUME OF THE TOTAL RANDOMIZED PLOT	ACCOUNT FOR OVERLAP OF SPHERES
----------	-------------------------------------------------------------	-----------------------------------------------	--------------------------------

	Variable Name	Current Value
1	current_volume	65.8404
2	idx	13
3	ms	0.2
4	random_inner_r...	1.50539
5	random_locatio...	469.497
6	random_locatio...	20.8644
7	random_locatio...	145.721
8	random_radius_1	2.50539
9	total_volume	50992.9
10		

	Variable Name	Current Value
1	current_volume	11418.5
2	idx	103
3	ms	0.2
4	random_inner_r...	12.9716
5	random_locatio...	139.314
6	random_locatio...	121.853
7	random_locatio...	35.7566
8	random_radius_1	13.9716
9	total_volume	974709
10		

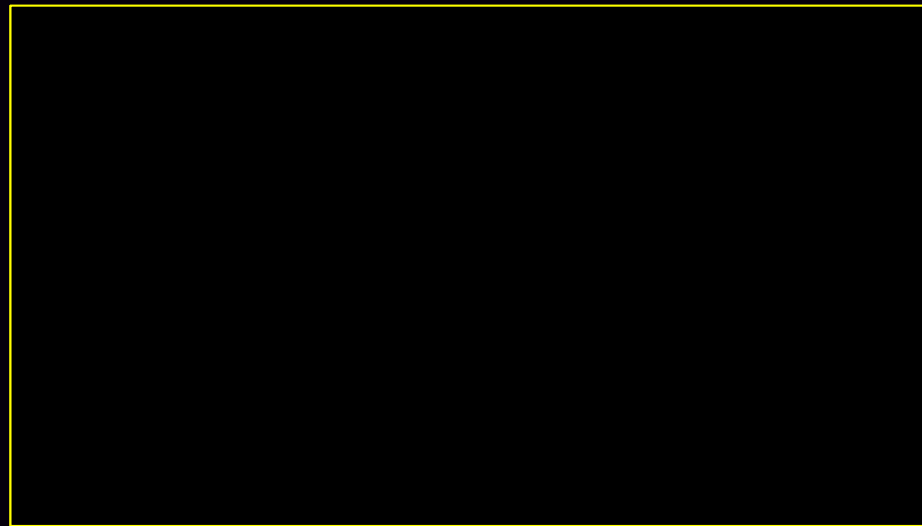
	Variable Name	Current Value
1	current_volume	3210.26
2	idx	1003
3	ms	0.2
4	random_inner_r...	8.15287
5	random_locatio...	471.653
6	random_locatio...	427.068
7	random_locatio...	454.452
8	random_radius_1	9.15287
9	total_volume	8.92879e+06
10		

# Implementation

## Process: SPRINT III

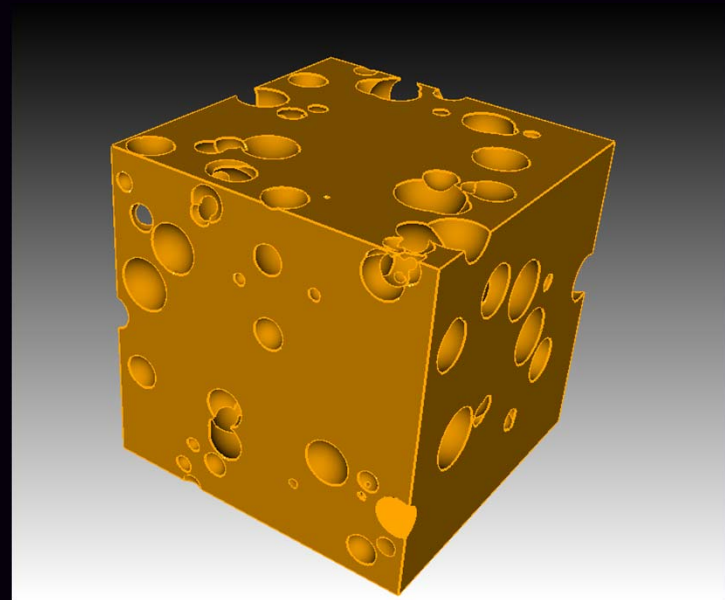
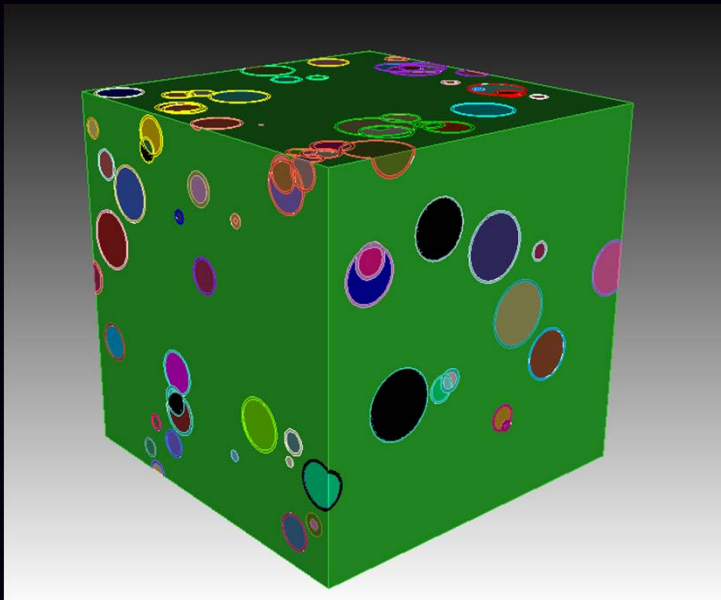
SPRINT 3	CALCULATE TOTAL VOLUME TO PREDICT ELECTROMAGNETIC BEHAVIOUR	CALCULATE VOLUME OF THE TOTAL RANDOMIZED PLOT	ACCOUNT FOR OVERLAP OF SPHERES
-------------	-------------------------------------------------------------------	--------------------------------------------------	--------------------------------

PT 1



# Implementation Process: **SPRINT IV**

SPRINT 4	SIMULATION COMPLETION	CODE AND MESH FINALIZATION	FINAL MODE SIMULATION
-------------	-----------------------	----------------------------	-----------------------



# Meeting

The screenshot shows a Safari browser window displaying the Google Docs Template gallery. The browser's address bar shows 'docs.google.com'. The page title is 'Template gallery'. The 'General' tab is selected, showing a grid of templates. The templates are categorized into 'Howard University' and 'Personal'. The 'Howard University' category includes: Lesson plan, Book report, Field trip, Spanish Quiz flash cards, Materials, Science project, My discoveries, Science fair by Google Science Fair, and Student certificate. The 'Personal' category includes: First point, General presentation, Making Presentations That Stick by Made to Stick, Photo album, and Wedding. The browser's top bar shows the date 'Thu Feb 16 1:10 PM' and various system icons.



Aweil, Marvin P

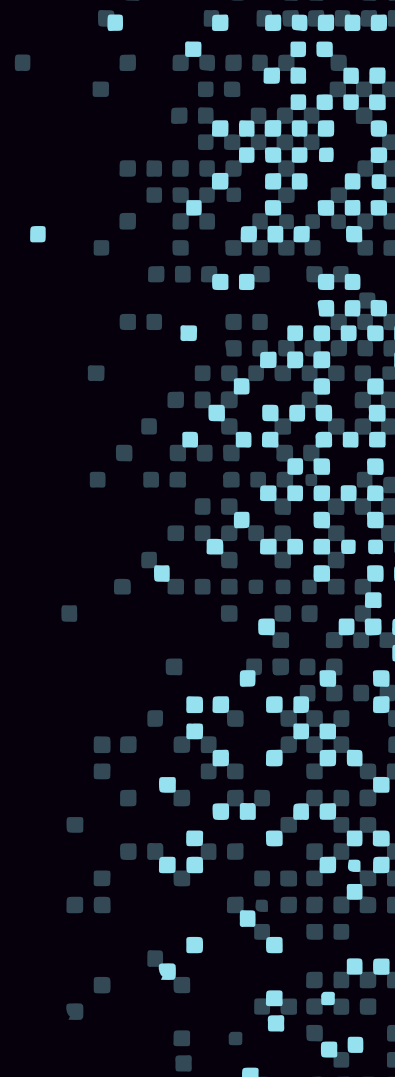
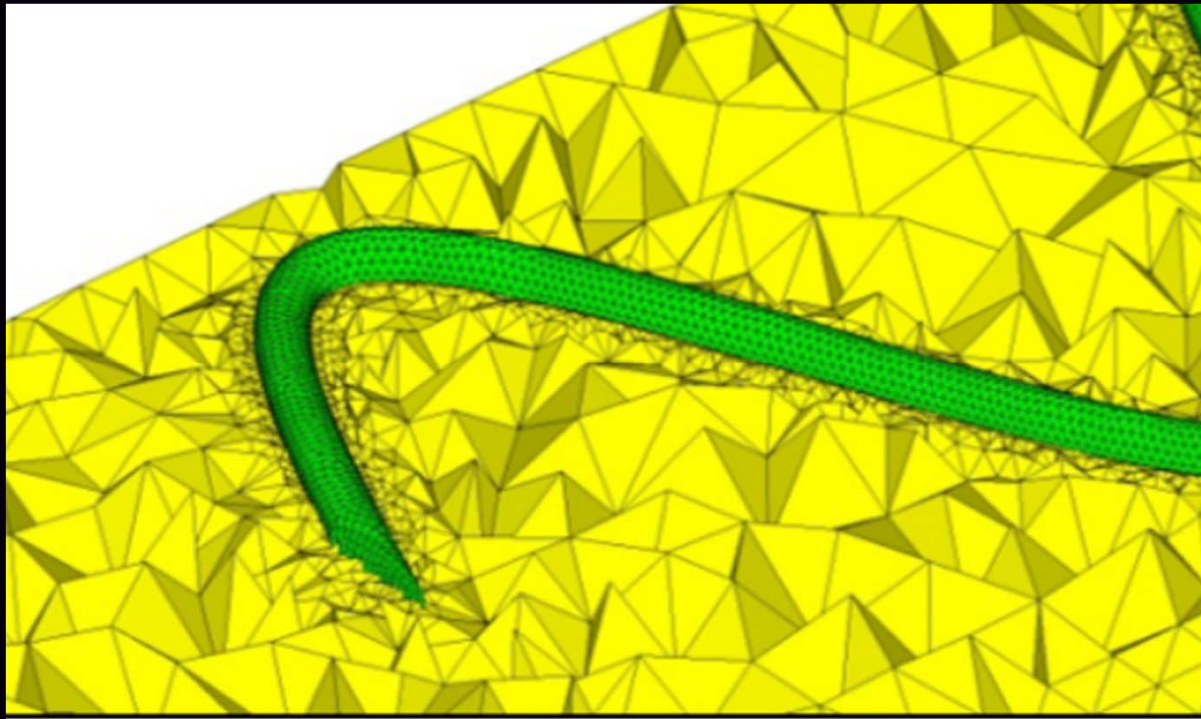


Abulomah, Choom



Awonyi, Andrew O

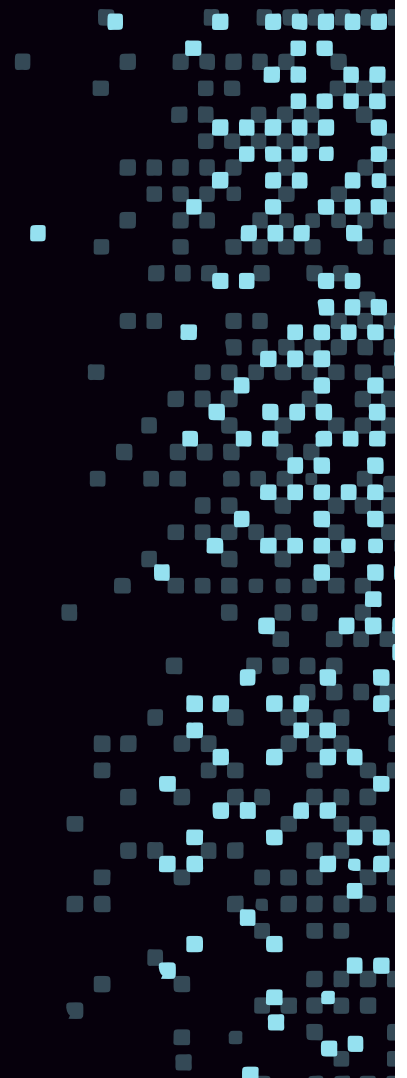
# Conclusion



# RESOURCES

MORE INFORMATION PERTAINING TO THE ON-GOING RESEARCH CAN BE FOUND ON:

[Multiphysics and Multiscale Simulation Methods for Electromagnetic Energy Assisted Fossil Fuel to Hydrogen Conversion](#)





THANK YOU

ANY QUESTIONS???