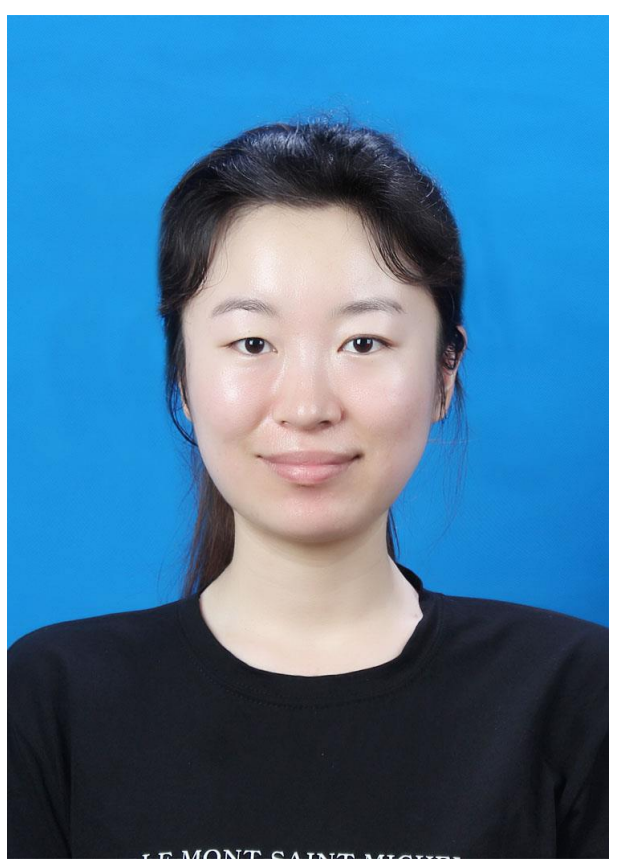


Electromagnetic Characteristics of a Bitter-like HTS Magnet Excited by Flux Pump with Thermal Switch

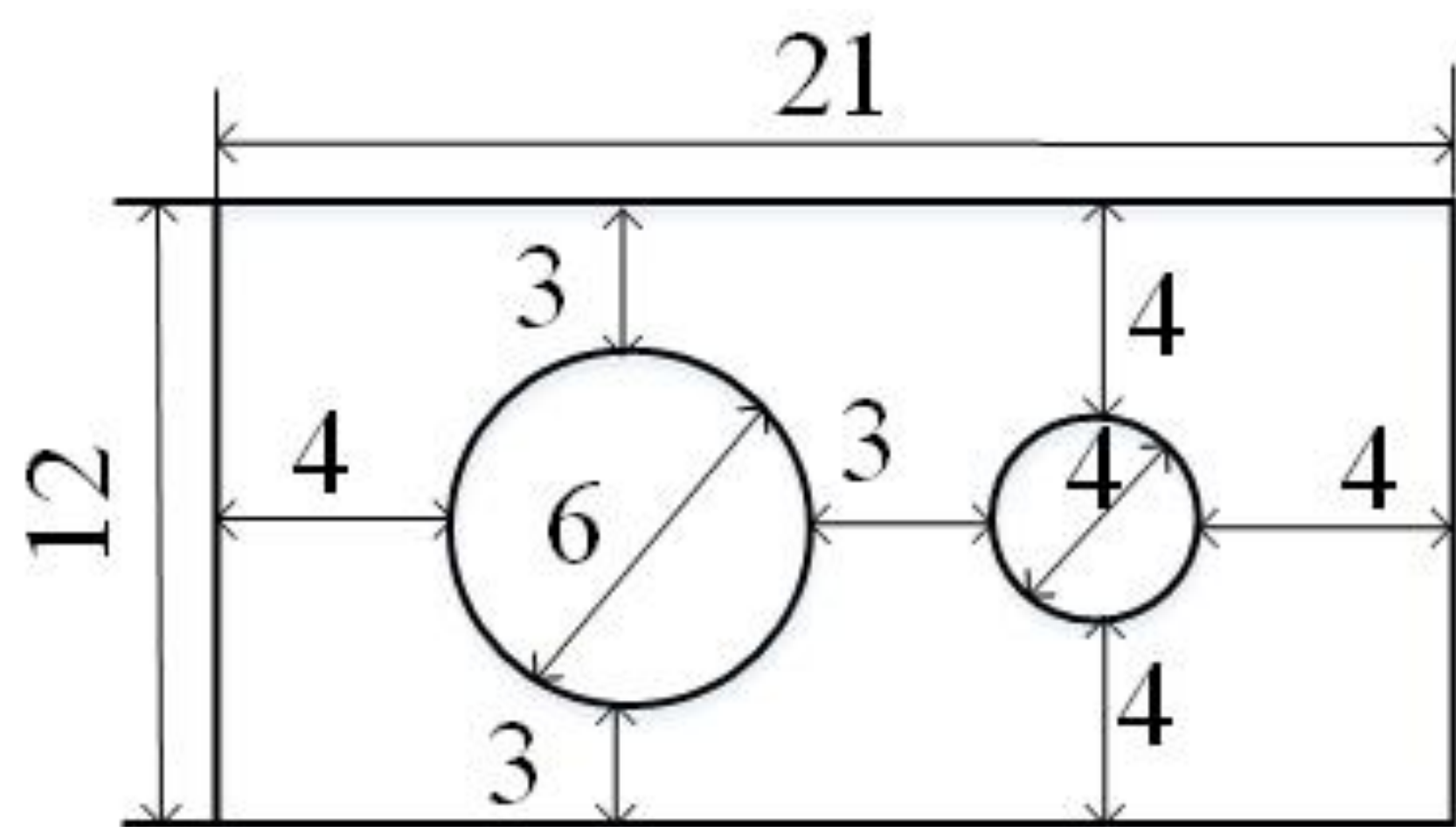
Jiawen Wang, Yinshun Wang, Xindan Zhang, Zhenghao Huang, and Wei Pi
State Key Lab. of New Energy Renewable Power System, North China Electric Power University, Beijing, 102206, China



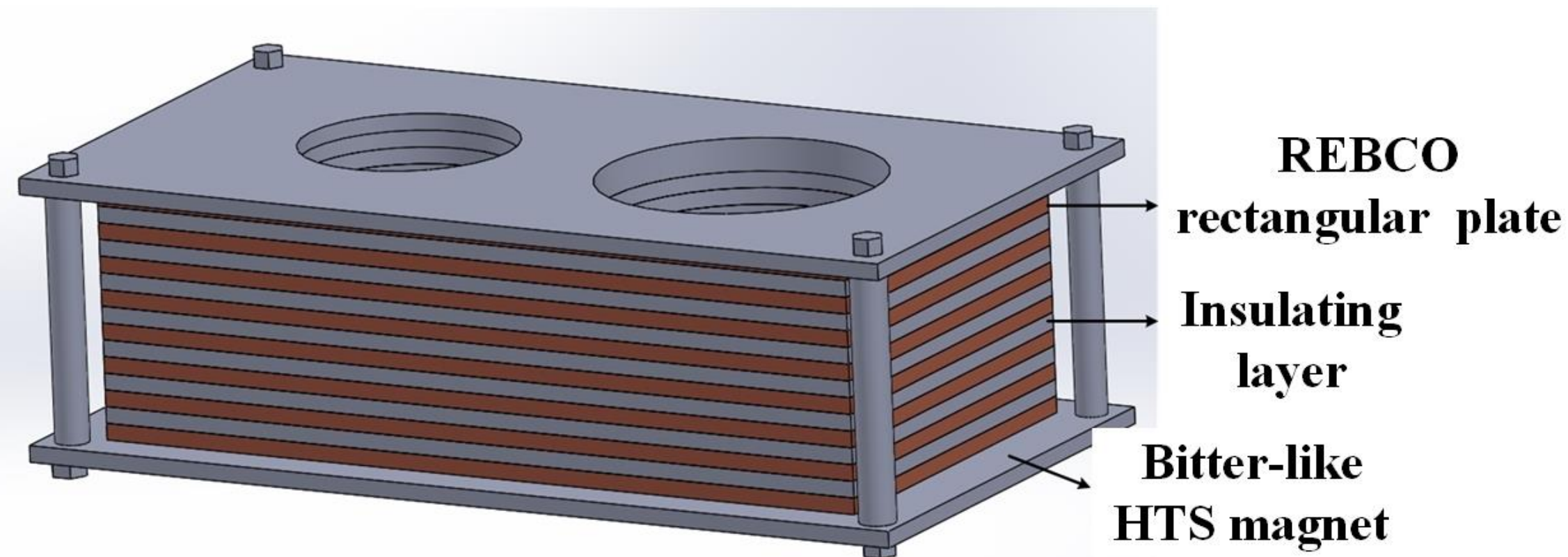
I. INTRODUCTION

- ◆ HTS made by BEBCO tapes are extensively applied in recent years.
- ◆ Difficult to realize the closed-loop operation because of the immature soldering technique.
- ◆ Bitter-like HTS magnet stacked by rectangle REBCO plates and magnetized by flux pump or field-cooling is a promising to overcome such drawbacks without joint resistance.
- ◆ Bitter-like HTS magnet is excited by flux pump with thermal switch, and the magnetic flux of rectangular REBCO plates are unevenly distributed. Therefore, it is important to analyze the electromagnetic characteristics, which lays a crucial foundation for the application of magnets.

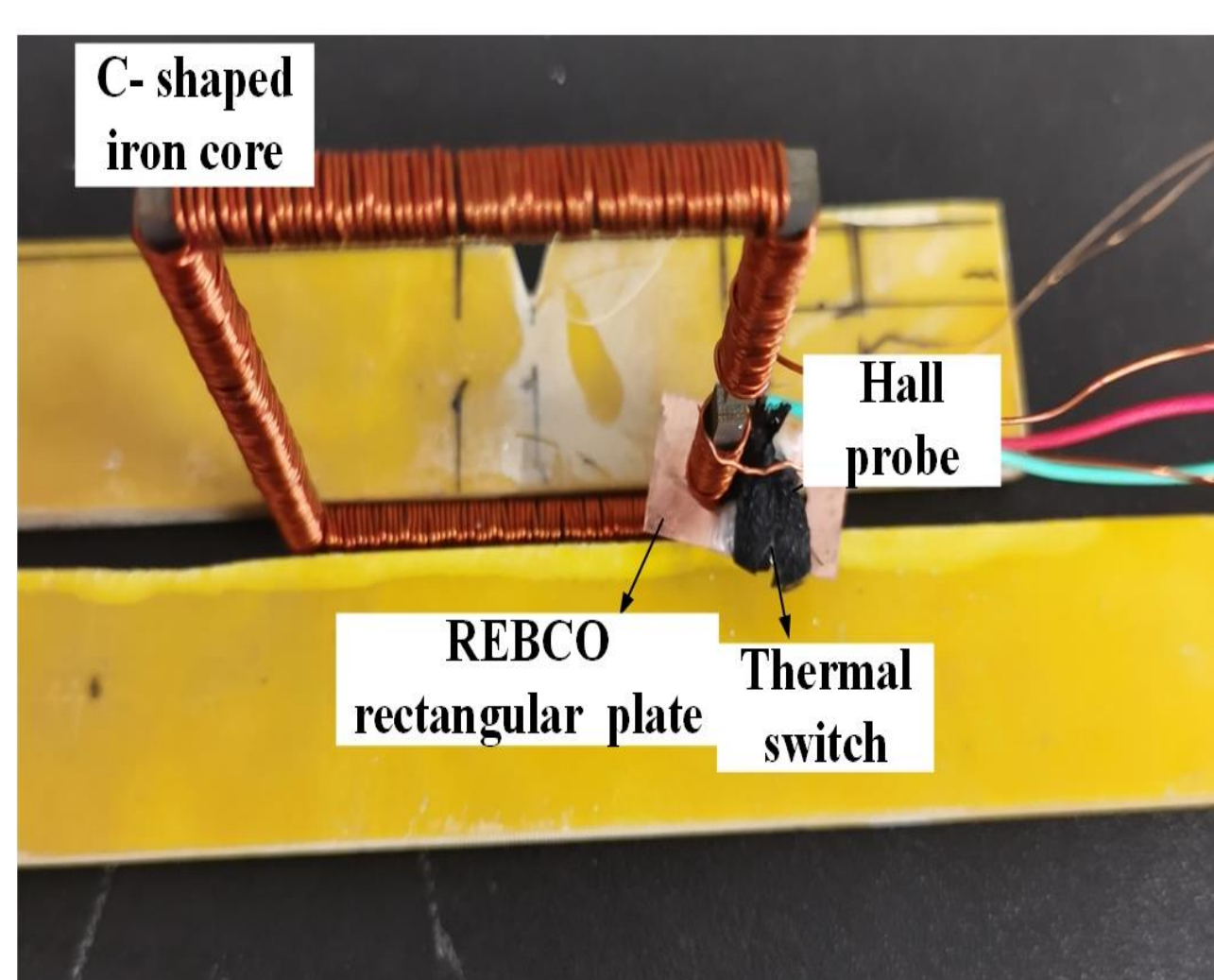
II. EXPERIMENTAL SETUP AND MEASURING SYSTEM OF A BITTER-LIKE HTS MAGNET



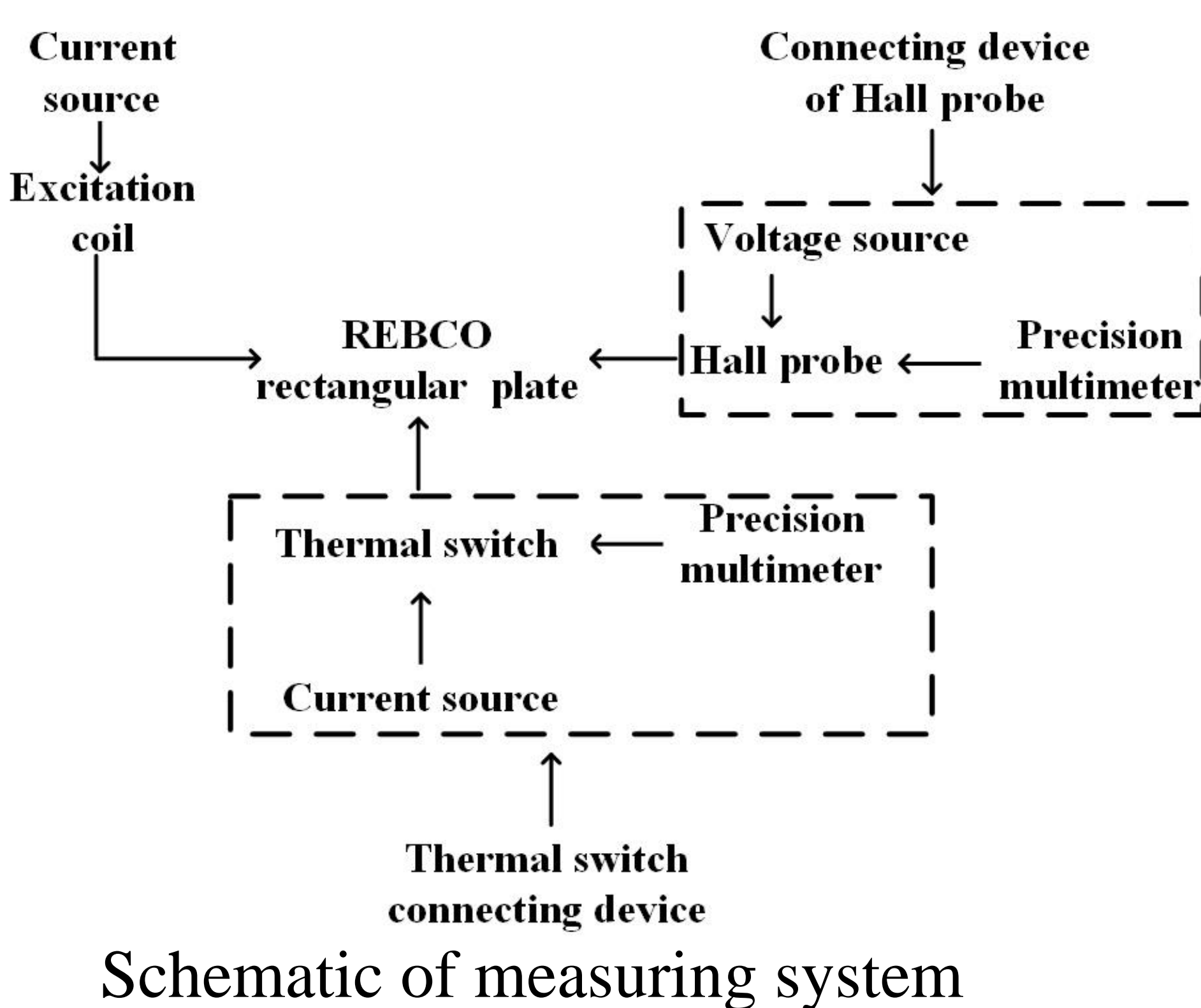
Picture drawing and size of REBCO rectangular plate



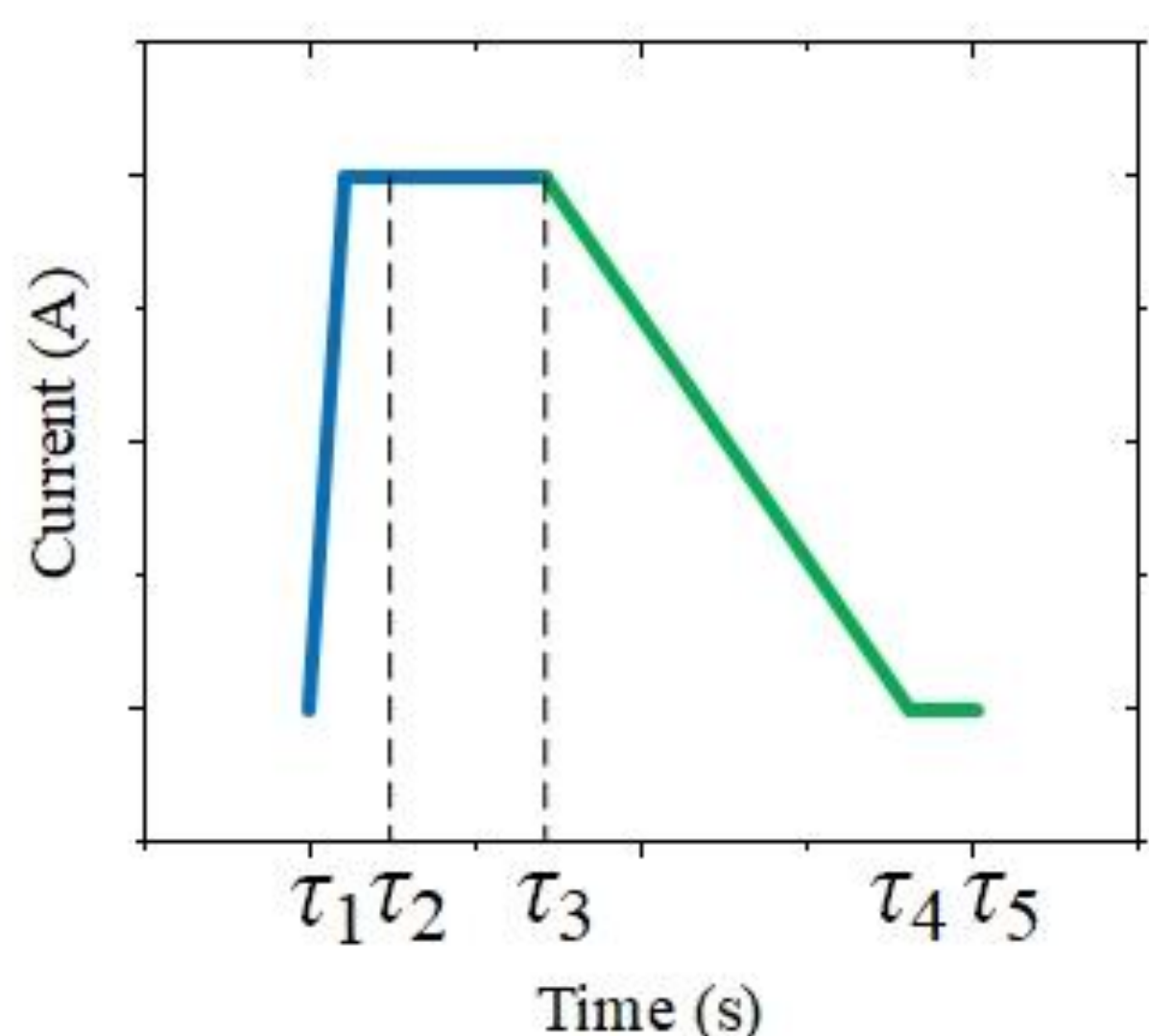
The structure of Bitter-like HTS magnet.



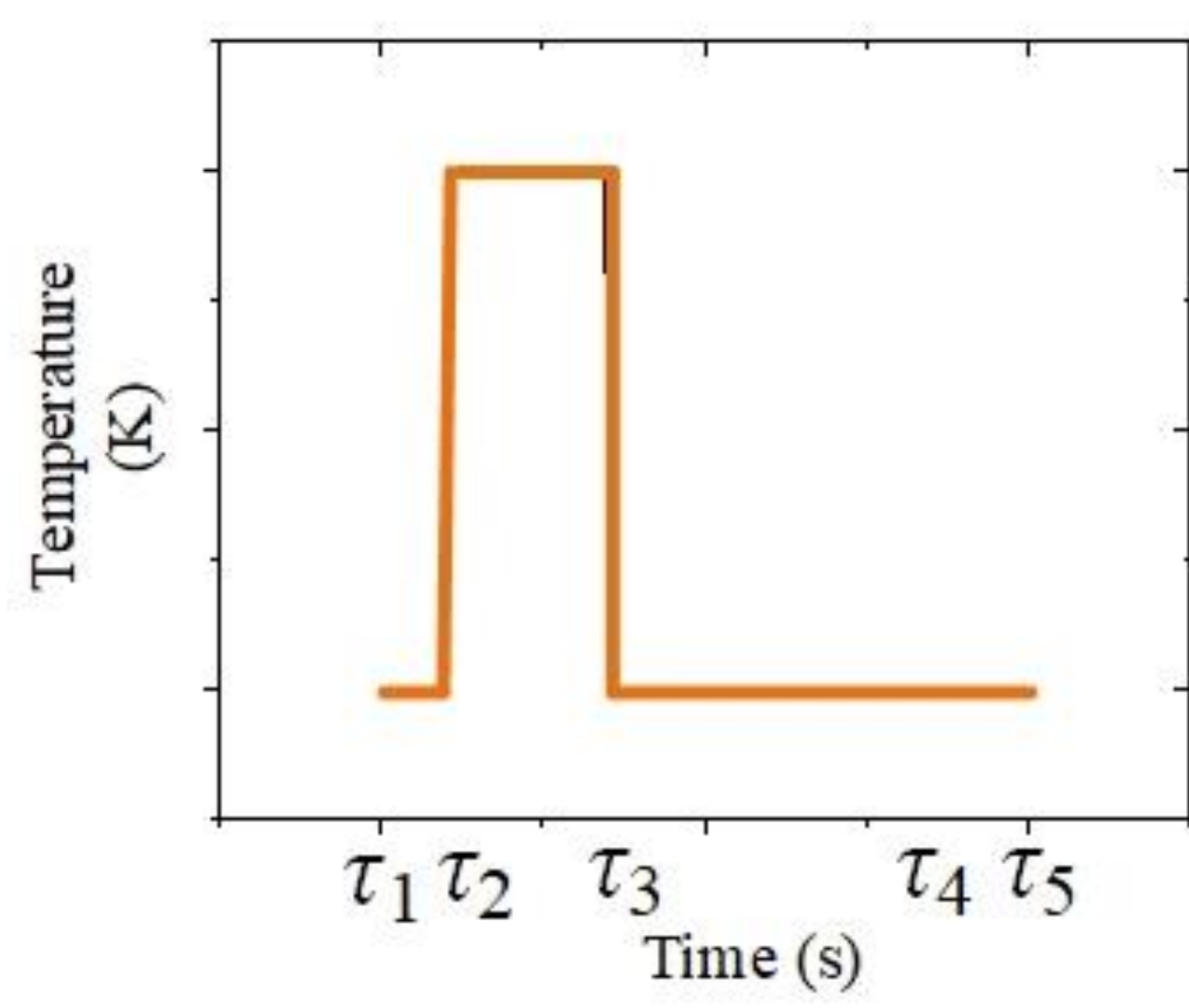
Schematic view of experimental setup



Schematic of measuring system



Schematic of excitation coil flux waveform



Schematic of temperature in thermal switch

III. NUMERICAL ANALYSIS

This paper use the finite element method to solve Maxwell equations in 3D dimension.

$$\mu_0 \mu_r \frac{\partial \mathbf{H}}{\partial t} + \nabla \times (\nabla \times \rho \mathbf{H}) = 0$$

Boundary condition

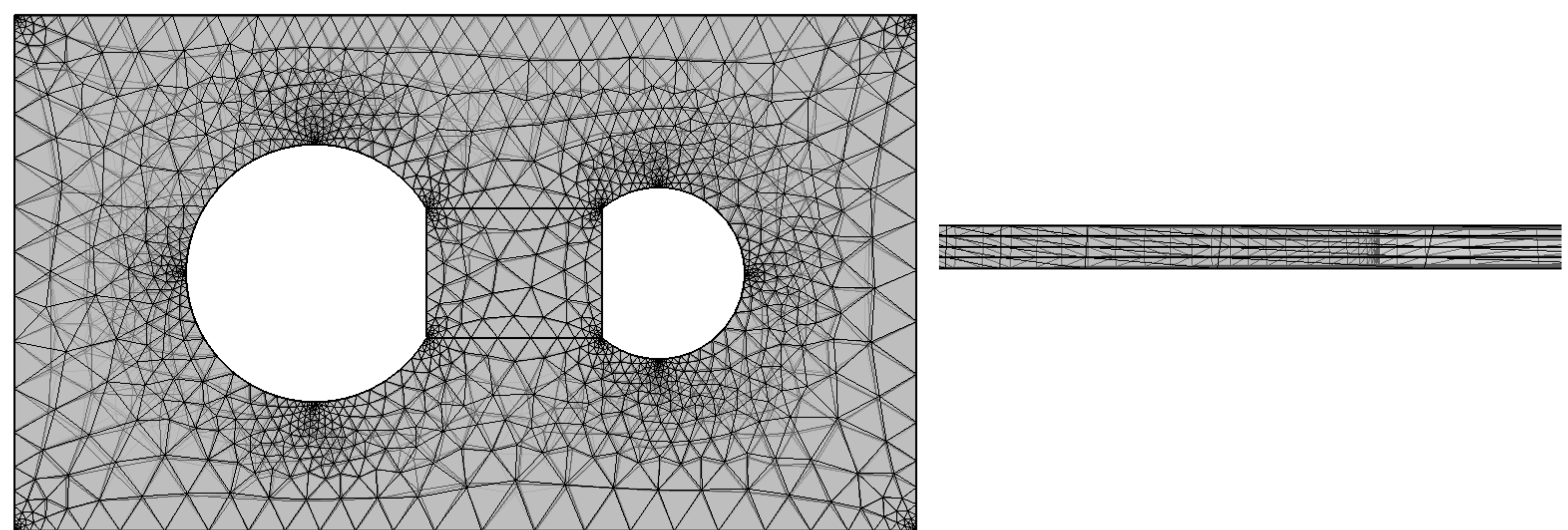
$$H_x = H_z = 0$$

$$H_y = f(t)$$

Initial condition

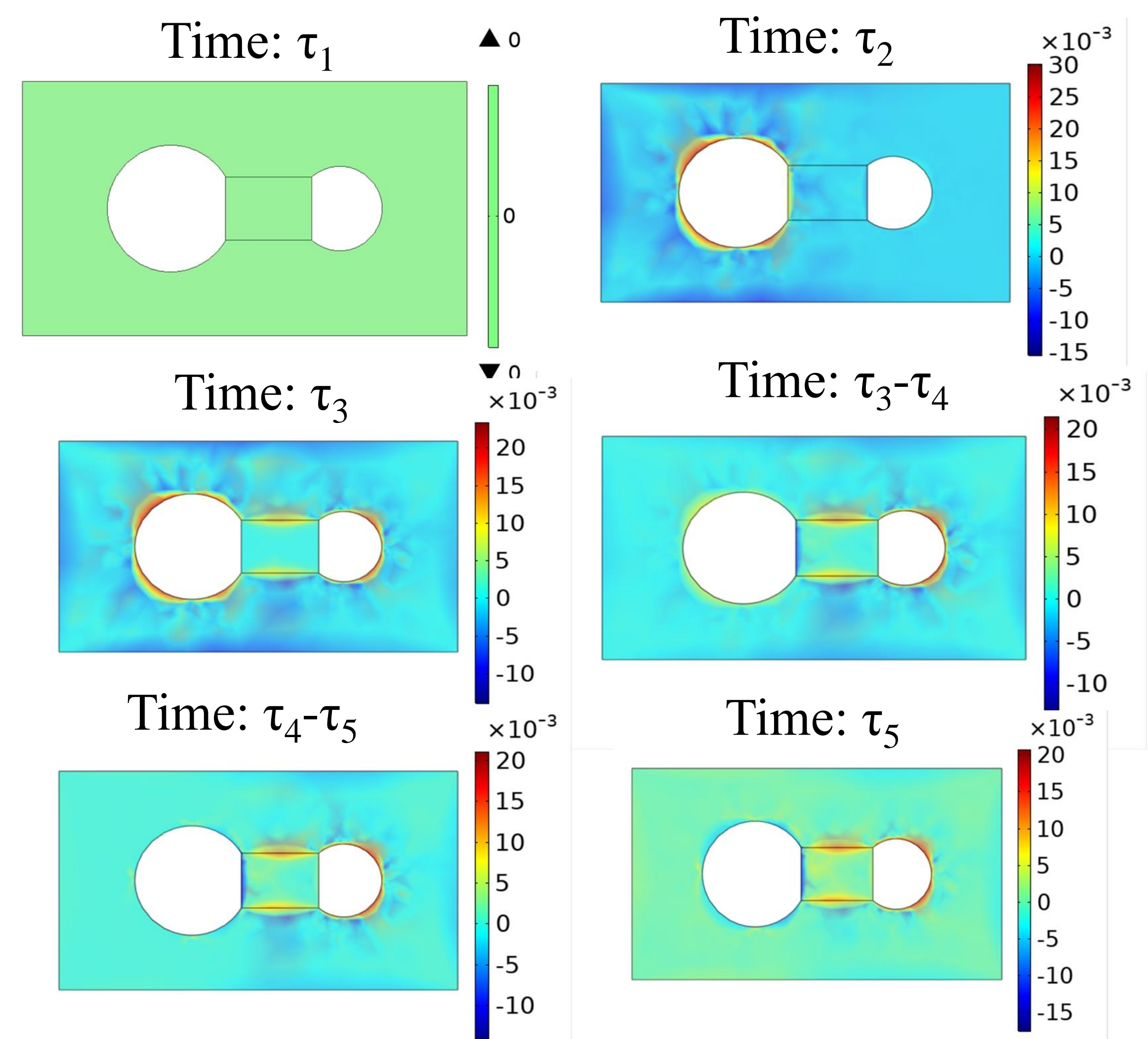
$$H_x = H_y = H_z = 0$$

$$\frac{\partial H_x}{\partial t} = \frac{\partial H_y}{\partial t} = \frac{\partial H_z}{\partial t} = 0$$

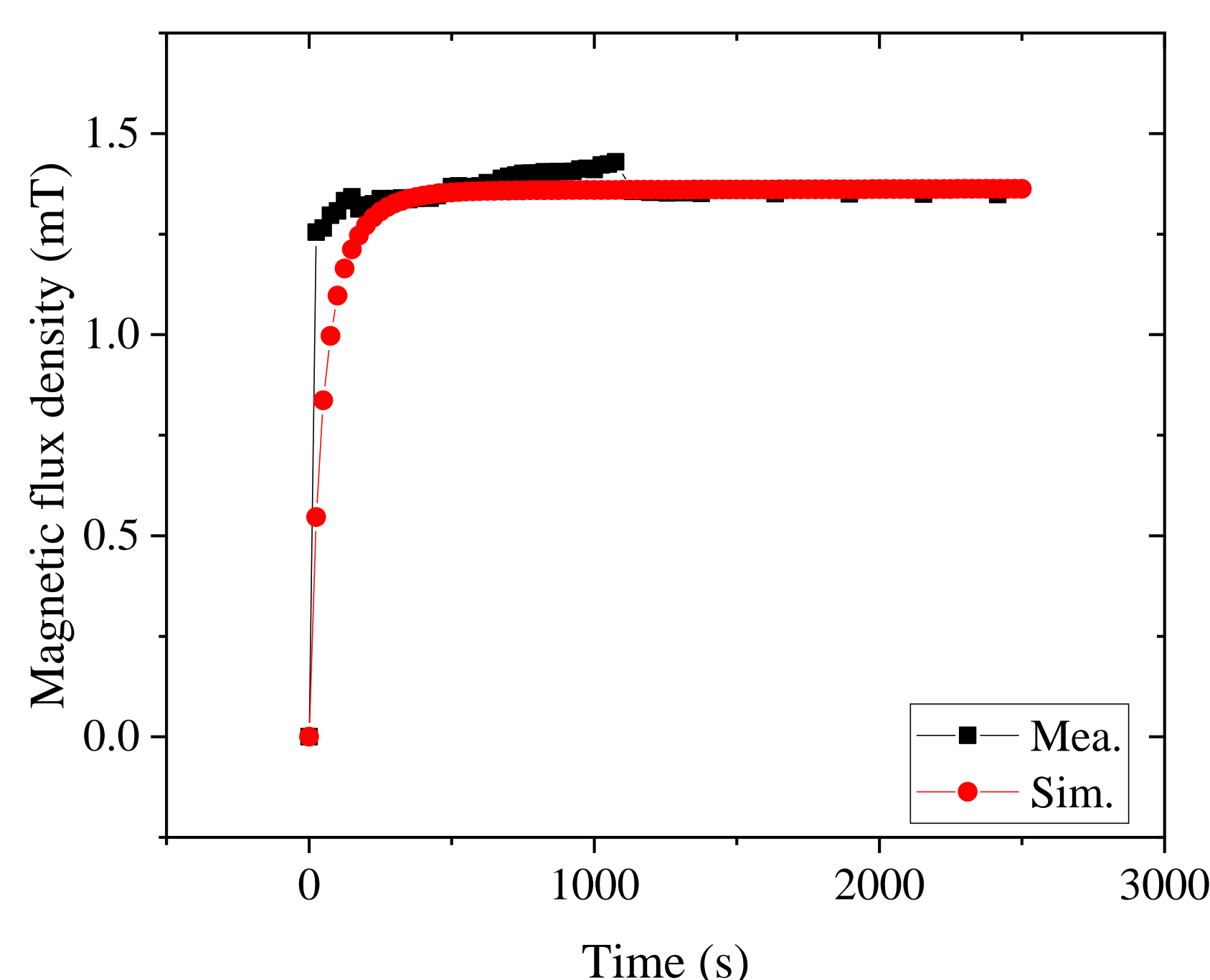


Mesh of REBCO rectangular plate using triangle division.

IV. RESULTS AND DISCUSSION



Magnetic field distribution of single REBCO rectangular at magnetized current amplitude of 10 A



The simulation induced magnet flux density at the center of small loop at the amplitude 10 A (magnet made from four REBCO rectangular plates).

V. CONCLUSION

- ◆ Bitter-like magnet can be excited by flux pump with thermal switch and realize the closed-loop operation.
- ◆ Magnetic flux density of the HTS magnet increases until the resistance characteristics do not change any more.
- ◆ Although available sizes, the conclusions can be extended to other sizes.