## 1. AC losses simulation of HTS

During PHD, I performed a pioneering study on completing the theory of frequency dependence of HTS ac losses. Through the numerical simulation considering all the layers of HTS coated conductors and the applied frequency up to 15 kHz, it is found that there is a transition frequency, above which the ac losses per cycle no longer increase with the frequency as the theory predicts. This is mainly due to the fact that the losses in the metallic layers is not the commonly defined eddy current losses, but transport current loss. The underlying mechanism is that the current flowing through the metallic layers is transport current driven by the power supply and the coupled magnetic field rather than eddy current. (https://doi.org/10.1063/1.5094727). Later, using simulation, it is found that the geometry, especially the width of copper stabilizers strongly affects transport ac losses: wider copper stabilizers would bring about much higher losses due to the inhomogeneous current distribution among the copper stabilizers (https://doi.org/10.1109/TASC.2019.2904204). These findings are valuable for the design and optimization of HTS CC-based power devices. Due to these studies, I have been awarded the 2018 ASC Best Student Paper in Seattle.

## 2. Current decay modelling of closed-loop HTS magnet

I have developed the numerical models for the current decay characteristics of closed-loop high-temperature superconducting magnets. A 2D FEM model with a circuit model is developed and experimentally validated. The model is effective in predicting the current decay behavior of closed-loop HTS magnet and provides a high degree of accuracy. With the use of this model, the characteristics of current-carrying closed-loop HTS magnet under various applied alternating fields are numerically investigated (Effect of local and global screening current on the current decay in closed-loop HTS coils, under review). Later, based on the EDS scenario, I have established a 3D FEM model of a real-scale HTS coil based on the H-formulation. The validity of the model is verified by comparing the experimental results with a small prototype. On this basis, the current decay characteristics of a closed-loop HTS magnet are investigated in response to changes in the external field. The mechanism of transient AC loss on current decay is deeply analyzed (https://ieeexplore.ieee.org/document/9738460).

## 3. Numerical model development for HTS flux pumps

I have developed the modelling of the HTS flux pump including the numerical models for a transformer-rectifier type of HTS flux pump by using the 2D H-formulation implemented in COMSOL (https://doi.org/10.1109/TASC.2020.2978787). Later, a lumped circuit model for HTS flux pump has been established and experimentally validated. (https://doi.org/10.1016/j.cryogenics.2022.103486). The coupling between the FEM and electrical circuit is also a topic I am interested in. By using such model, it is possible to assess the overall behaviors of complex HTS applications, while keeping a high degree of precision on the presentation of local effects. In the recent, applicant has extended the capability of the original version to large-scale HTS applications with multiple power items (https://iopscience.iop.org/article/10.1088/1361-6668/ac93bd/). Based on this modeling strategy, I propose a methodology for coupling HTS coil and flux pump models using an electrical circuit, resulting in reduced computation costs. enabling a comprehensive evaluation of the overall performance of self-regulating HTS flux pumps while accurately capturing local effects. (https://iopscience.iop.org/article/10.1088/1361-6668/acf739). Additionally, I successfully built a model for HTS flux pumps for reproducing the dynamic charging process of the HTS flux pump and to predict the AC losses of the whole system in different charging stages (Modelling the Dynamic Charging Process of High-Tc Coils by Dynamo-type Flux Pump, topic for HTS 2022).

## CONTACT INFORMATION:

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## EDUCATION:

2014.9-2020.9
PhD in Engineering at Southwes Jiaotong University, China

## WORK EXPERIENCE:

2021.8-2023.8
Postdoctoral Researcher at Karlsruhe Institute of Technology
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## PUBLICATIONS:

[1] **Pengbo Zhou**, Gang Ren, Mark Ainslie, Asef Ghabeli, Shuai Zhang, Yao Zhai, and Guangtong Ma, “Impact of Magnet Number on the DC Output of a Dynamo-type HTS Flux Pump,” *IEEE Transactions on Applied Superconductivity*, 2023, 33(8): 4603509.

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Temperature Superconducting Coated Conductors," Journal of Applied Physics, 2019, 126(6): 063901.
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[21] Yuke Deng, Chao Wang, Jing Li, **Pengbo Zhou***, Kang Liu, Tianyong Gong, Hengbin Cui, Xue Deng and Guangtong Ma, "Observation of the Current-decay and Force-variation of a Flux-Pumped HTS Magnet Subjected to Travelling Magnetic Fields," *Journal of Superconductivity and Novel Magnetism*, 2020, DOI:

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## AWARDS/ HONORS:

Nov 2018 **The Best Student Paper in Materials-**Third Place presented at the 2018 Applied Superconductivity Conference, Seattle, USA.

## CONFERENCE EXPERIENCES:

1. 2015. International Conference on Magnet Technology, Seoul, Korea, poster presentation;
2. 2016. Applied Superconductivity Conference, Denver, USA, poster presentation;
3. 2018. Applied Superconductivity Conference, Seattle, USA, poster presentation and student contest;
4. 2019. International Conference on Magnet Technology, Vancouver, Canada, poster presentation.
5. 2022. Eighth International Workshop on Numerical Modelling of High Temperature Superconductors, Nancy, France, 2022, poster presentation.