Magnetotomography
Investigation on a new method for fuel cell current density distribution measurement

Master Project (30 ECTS) / Semester Project (10 ECTS)

Administrative

Supervision:	Stéphane Weissbaum, Prof. J. Van Herle
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Location:	Sion or remotely (travel allowance offered)
Remarks:	If interested, please send your CV, with a short motivation letter, to Stéphane.

Project description:

The high DC current density **j** flowing inside a fuel cell or electrolyzer generates a measurable magnetic field **B** around the stack, which can be simply calculated via the Biot-Savard law.

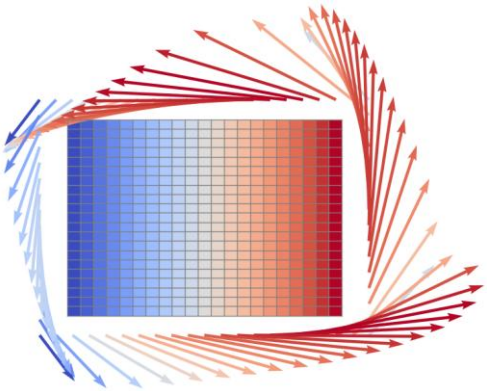
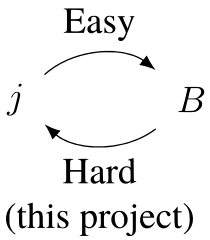


Figure 1 -Simulation of the magnetic field around a rectangular fuel cell with a current density gradient (left to right).

Problem: In practice however, we are faced with the inverse problem – Based on the external magnetic field measurements, how to infer the current density? This problem is non trivial and requires advanced numerical methods (inverse problem solving, pseudoinverse, regularization, SVD, ...). Magnetotomography is this technique of using small magnetometers to reconstruct an image of the internal current density in the 2D MEA of a fuel cell.



Your tasks:

- **Literature review**: Find out how other research groups used magnetometers in their setup and what were their results. GEM is in close contact with a group working on the topic for more than a decade and can benefit from their support to build its own expertise.
- **Problem solving**: Define the problem first mathematically, then try to solve it numerically in your preferred environment (Matlab, Python, other). Evaluate the performance of your solution and see if it can be quick enough to be used on a real stack.
- **Lab work/Validation**: Take real data with a small magnetometer on a real or dummy stack (array of 3x3 wires in which you can pass arbitrary currents) and see if you can infer the currents with your solution.
- **Future work**: Evaluate potential upgrades of the setup and identify key points for further research in this field.