GEOMAGNETICALLY INDUCED CURRENTS IN POWER SYSTEMS

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Shield Wires effect on GICs in power network and design of an instrument to monitor GICs
Geomagnetically Induced Currents in Power Systems

Changes in the magnetic flux induces voltage potential on surface of earth
The importance of GICs mitigation

Numerous records of damage and wear of electrical network components

Half-cycle saturation of power transformers
(One of the main problems in power systems)

**GIC Modelling**
 to understand damage to Power Systems

**GIC Measuring**
to validate the models

From Marusek, 2007
1. GIC Modelling

The effect of the Shield Wires
Shield Wires

Protect the power transmission line from the effect of lightning
Model for analysing the effect of shield wire on GIC

- Power line resistance
- Induced emf along the power line
- Resistance of each shield wire span
- Grounding resistance at each tower
- Transformer wiring resistance
- Substation grounding resistance
In Portuguese Power Transmission Network, first initial tests on single lines gave errors of 5% for a short line, if shield wires were not considered.

It is important to study this effect and understand if it is necessary to include shield wires in the GIC calculation models.
How can we simplify this study?

Getting a simpler circuit!

In which it would be sufficient to deal with a Thévenin equivalent circuit connected to each substation, as shown on the left.
Results in a simulation where the induced electric field along shield wires has been neglected.

Credits to Joana Alves Ribeiro
2. GIC Measuring

The design of an equipment to monitor GICs
The first prototype will be installed to measure the **neutral point current** on a transformer, at a substation belonging to the national transmission system operator (REN).
Grafana Dashboard

It will be possible to obtain the data in real time and a wi-fi interface allows rapid long term trend visualization through a customized dashboard - Grafana.
THANKS!

Any questions?
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