Traveling Wave Protection for Distribution Grids with Renewable Energy Sources

**Supervisor**  Nadezhda Davydova, davydovn@eeh.ee.ethz.ch

**Type**  Semester/Master

**Background**  High penetrations of distributed generation (DGs) in distribution grids and development of microgrids may cause malfunctioning of conventional distribution level protection systems. Despite multiple works dedicated to addressing this problem, the development of reliable, high-speed, and cost-efficient protection systems for active grids remains a topical issue. Traveling wave based protection systems is a promising solution since they are fast and essentially not affected by the operation modes of DGs and microgrids.

**Description**  The main objective of this thesis is to extend and test a recently developed in PSL traveling wave protection algorithm [1] for distribution grids with DGs. The exact topic can be tailored to the interests of the student. Potential tasks for the project include but are not limited to the following:

1. Review traveling wave theory and its application in protection algorithms.
2. Make the protection algorithm robust to switching transients and lightning strikes.
3. Extend the protection algorithm to be applicable for lines with various sources of discontinuities.
4. Add model of surge arresters to the test grid in EMTP-RV.
5. Test the developed algorithm for various fault instances and normal grid operation modes.


**Prerequisites**  The student should be familiar with MATLAB.