

HiWi/WiHi/Master/Bachelor Thesis:

Petri Nets based Dependability & Resilience of cyber-physical Smart Grid Automation

Context:

The ICT is becoming an integral part of the monitoring and operation of the power grids. The performance of the smart grid depends on the characteristics of ICT systems (communication infrastructure, automation devices & data aggregation systems). It is important to model the interdependencies of the communication infrastructure and the power grids in order to quantify the influence of the reliability and resilience of the communication infrastructure (LTE, Wired (ethernet), TSN etc..) on the performance of the automation of smart grids. Tests should be made to analyse the effect of cyber attacks on the communication infrastructure, the automation devices and data aggregation systems. For this purpose the failure models of individual components of the ICT infrastructure and the power grid components need to be modelled using Petri nets. Specifically using the stochastic (coloured) petrinets to understand the transient and steady state dependability and reliability indices for the combined ICT and power grid components. Different failure modes like the cascade failures, common cause failure need to be simulated and the reliability indices of the combined cyber-physical have to be quantified.

Your tasks:

The major tasks involved in the thesis are as tabulated below.

- Modeling the failure modes of specific communication infrastructures with stochastic /coloured petri nets and analyse the steady state and transient dependability & reliability
- Modeling the interdependency of the communication infrastructure and the automation systems of power distribution grids using coloured/stochastic petri nets
- Modeling the interdependencies between the automation systems and the power grid components and analyse the reliability and resilience in maximizing the power delivered using petri nets
- Automatic code generation to create the appropriate petri nets and reliability index calculation
- Investigation of different Petrinet libraries and implement the aforementioned petrinets

Profile:

We are looking for students with good programming skills. Basic understanding of petri nets would be helpful.

Contact:

Abhinav Sadu
Tel. +49-241-80-49473
asadu@eonerc.rwth-aachen.de

ACS | Institute for Automation of Complex
Power Systems
ERC | E.ON Energy Research Center
RWTH Aachen University
Mathieustr. 6, 52074 Aachen, Germany