**Semester Thesis Proposals (I)**

* **Identifying the common pattern(s) of the recent Critical Infrastructure (CI) incidents cased by the interdependencies**

The object of this semester thesis is to provide the complete compilation and evaluation of "major" incidents which demonstrate cascading failures caused by the interdependencies between CIs. For example, North American major blackout in 2003 had caused the disruption not only to electrical power system, but also other CIs such as Transportation, Railway system, Water Supply, and Telecommunication. Furthermore, the common pattern(s) of those events can be identified.

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* **Influence of node density to vulnerability of networks suffering large area damaging events**

The object of this semester thesis is to identify what is the influence of node density to the vulnerability of a network, such as the electric power grid, if large area damaging events (e.g. earthquakes) lead to the regional destruction of nodes?

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* **Influence of renewable energies and distributed generation on a reliability of the power system**

The electricity industry is having to incorporate a continuously rising amount of renewable energies and power generation is becoming increasingly decentralized. This work aims to discuss how far reliability of the power system is affected by renewable energies and distributed generation. The work should be based on a literature research and on a statistical analysis of reliability data e.g. of the UCTE / ENTSO-E.

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* **Collection and statistics of security incidents in industrial control systems**

Supervisory control and data acquisition (SCADA) networks contain computers and applications that perform key functions in providing essential services and commodities (e.g., electricity, natural gas, gasoline, water, waste treatment, transportation) to the society. Collection and statistics of these industrial security incidents become important for further identifying and analyzing the vulnerability within SCADA systems. Since it is part of a project on the security and vulnerability of information communication and technology in Switzerland, to collect the incidents occurring in Switzerland and find the present security status of Swiss SCADA systems would be most needed.

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**Semester Thesis Proposals (II)**

* **Method for the reliability analysis of an electronic safety system: Transferring the model into Markov chains**

For the reliability analysis of the protection system of a particle accelerator (LHC  at CERN), a modeling approach has been developed. The model of the system is currently implemented using Monte-Carlo simulation and a analytical description.  The underlying component model can be described based on Markov chains. As a next step, it is to be investigated whether and to which extent the whole system model can be transferred into Markov chains.

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* **General properties of complex systems *emergence and self-organization* analyzed from the point of view of one of the Critical Infrastructures (Electric Power Supply Systems or Information and Communication Systems or Transportation Systems).**

Critical Infrastructures are complex systems. They are often described through properties like high dynamic, nonlinearity, interdependencies, feedback loops, emergence and self-organization. The question is whether Critical Infrastructures are self-organized or do they exhibit emergence features (or both)? The goal of this semester thesis is to find out the answer for one of Critical Infrastructures.

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* **Reliability Databases for Risk Studies**

The project is based on a state-of-the-art overview over pre-selected databases of reliability data being currently available. Investigation and comparison of their structure, contained information and function based on specific components will be performed. The goal of the project will be to understand the influence of the differences of the various reliability data on risk analysis methods. Application in the framework of the Laboratory’s projects (Power Grids, Rail Transport, CERN, …) will also be considered.

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