# Reliability prediction using multivariate operational time-series

**Siemens** is a global powerhouse focusing on the areas of electrification, automation and digitalization. One of the world’s largest producers of energy-efficient, resource-saving technologies, Siemens is a leading supplier of systems for power generation and transmission as well as medical diagnosis. In infrastructure and industry solutions the company plays a pioneering role. As of September 30, 2014, we had around 343,000 employees in more than 200 countries.

**Siemens Industrial Turbomachinery AB (SIT AB)** in Sweden is part of the Siemens Energy Sector. The Energy Sector is the world’s leading supplier of products, services and solutions for the generation, transmission and distribution of power and for the extraction, conversion and transport of oil and gas. SIT AB delivers gas turbines, steam turbines, turn-key power plants, service and components for heat and power production. All under one roof – from research and development, manufacturing, marketing, sales and installation of turbines and complete power plants to service and refurbishing. There are today about 2 700 employees in Finspång.

**Project Field Experience** In SIT AB, a large amount of field experience data is continuously generated in form of various reports from maintenance events, component repair and operation history. These reports include detailed information about the turbine operation history as well as its condition and reported damages on individual components. This field experience data, although noisy, invariably portray environmental factors, measurement errors, and loading conditions, or in short, reality. By establishment of a process to collect and maintain this information in a database format, exploration and knowledge discovery using this data became a subject of high interest. This Master thesis is a part of efforts done to develop advanced visualization tools together with the proper sequence mining algorithms to discover the hidden relationships between different events and all the other affecting variables like loading, configuration and environmental parameters.

**Project description**

Gas turbines are complex and expensive rotating equipment which should work with a high reliability. The operational parameters of each gas turbine is monitored and collected in the form of analogue and digital signals which is known as time-series data. The history of maintenance events and failures of the core components is also available for each engine.

The goal of this project is to be able to find the patterns in operation that can describe the failures of the components. The result can be used to establish a prediction model that can predict the reliability factor for each installation based on the history of operation and desired operation profile in future.

The project is suitable for 1 student with good statistical and modelling background. The student should have the good knowledge of signal processing, pattern mining and sequence mining algorithms. Student will work closely with domain experts.