Student Intern: Electrical Propulsion Process Simulation

Join ABB and work in a team that is dedicated to creating a future where innovative digital technologies allow greater access to cleaner energy.

General information

In the Marine Software Development Center (MSDC) in Krakow, we have a need for developing a dynamic, numerically solved simulation model of a process of propulsion of a vessel (ship) by electrical propulsion, grounded in solid understanding of physical behavior of rigid bodies immersed in fluid, as well as of electrical-mechanical conversion of power and energy flows through rectifier-inverter (frequency converters, drives) systems feeding synchronous and asynchronous rotating machines (motors). Such models are important for validating and verifying the function of a so-called Propulsion Automation Solution for controlling the electrical propulsion power-train of a typical 21st century electrical propulsion vessel, in an integration test, in either SIL (software-in-the-loop) or HIL (hardware-in-the-loop) configurations of the test-bed.

You will learn about how electrical-mechanical conversion works at a simple, behavioral level associated with accurately capturing the nature of the active power flow. You will learn how the mechanical load of the propeller moving entrained water is reflected, and can be observed as the electrical load on a typical island grid onboard an electrical propulsion vessel, and how it exerts influence over a non-stiff grid. You will further learn about the nonlinearities imminent in the process of water propulsion using a screw propeller, and simplified and satisfactory ways of modelling those complex behaviors, such as (Robinson) Propeller Curves, as well as about the process of electrical braking that is used in electrical vessels, trains, cars, and cranes. You will explore what sources of data are available in ABB systems, databases, and cloud data warehouses / lakes that will allow you to build such process models. You will learn to implement these models in tools such as Jupyter notebooks, Matlab / Simulink etc. You will learn how to connect such models via measurement points (model outputs, control system inputs) and set points (model inputs, control system outputs)

You will work under supervision of, and in the team with the Digital Twin Product Owner, Michal Smolana, and other members of the Digital Twin initiative.

Your responsibilities

- Maintain an open, learning-focused attitude and use appropriate time, energy, focus, and resources to study up on subjects that will come up during the internship, and that you are not yet familiar with.
- Develop your orientation to detail, meticulousness, precision, and clear thinking from problem to solution. Learn to use visual and other learning aids, like sketches, plans, charts etc. to develop this skill.

- Develop your ability to take increasingly active participation in technical discussions and help knowledge, information, ideas, and positive work attitude spread throughout the team.
- Learn by doing, and exercise in a progression of scenarios and toy problems, from less to more complicated, the specifics of electrical propulsion process modelling and simulation.
- Raise up your voice and maintain transparent and honest communication, including feedback about whether the pace of work and assimilation of new information is appropriate, towards your supervisor.
- Focus on doing more simple exercises and implementation rather than trying for a very complicated magnum opus and overshooting your internship deadline.

Your background

Must-haves

- Pursuing a B.Sc or M.Sc degree in natural sciences or technical sciences
- Demonstrable skill and background knowledge equivalent to late year students of the above can substitute, for students of other disciplines
- Strong and error-free, detail-oriented university-level capability in linear algebra and calculus, familiarity with the ideas of matrices, determinants, spectra, eigen-vectors and eigen-values of matrices, matrix equations, exponentiation, inverse, rank, and degree; analytical functions; differential equations; analytical and numerical integration techniques
- Strong and error-free, detail-oriented university-level capability in algebra and analysis of complex quantities and complex-valued functions
- Ability to communicate in writing, on chat, or in teleconference calls clearly, concisely, and politely in English

Nice-to-haves

- Ability and interest to continue with a student placement / student job until end of 2021 is very welcome, and a priority
- Familiarity with fundamentals of mathematical representation, analysis, and design of simple electric circuits, familiarity with the ideas of resistance and impedance (complex resistance), vector representation of alternating electrical quantities in 1- and 3-phase systems (currents, voltages – line and phase, active and reactive power etc.), familiarity with the fundamentals of frequency conversion and of the process of electro-mechanical power conversion (principles of motors and generators), is a plus, but not required
- Familiarity with basic, LTI-solving numerical simulation tools, preferably MathWorks Matlab, but possibly also National Instruments LabView or equivalents, is a plus, but not required
- Familiarity with Python, and especially the scipy, numpy, and pandas packages is a plus, but not required