

---

# Student Intern: Ship Modelling and System Identification

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 cross-cutting need for developing ship dynamic models, grounded in solid understanding of physical behavior of rigid bodies immersed in fluid, expressed as concentrated parameters state-space models (non-linear matrix equations expressing derivative of state-space vector as non-linear matrix equation of functionals of full or partial state-space and steering / thrust inputs vectors). These models are important for multiple technologies based on which we deliver value to end-customers (ship owners and operators) through different digital products, primarily through the Autonomous Shipping Growth Initiative and associated product lines of Bridge Systems, and the Digital Service portfolio, primarily through the Advisory Services line.

You will learn about how rigid-body physics models of ships, with concentrated parameters, approximated by center of gravity and center of buoyancy dimensionless points and actuated by generalized forces and torques are constructed (if you don't already know), and what simplifications from full hydrodynamics finite-element models are warranted, useful, and maintain consistency, sanity, and sufficient accuracy of the model you arrive at. 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 models of select vessels. You will learn to implement these models in tools such as Jupyter notebooks, Matlab / Simulink etc. You will learn how to simulate controllers derived from knowledge of parameters of such models, while controlling models with drifted / biased parameter values, to test for robustness of controller design.

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 ship dynamic modelling and system identification.
- 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
- 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 linear time-invariant model analysis and synthesis / design techniques, usually taught as part of a control engineering, automation, or cybernetics majors in technical universities, 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