MSc Thesis at ABB Corporate Research, Västerås, Sweden

Modern maritime navigation is heavily dependent on satellite systems for accurate and real-time positioning. Several Global Navigation Satellite Systems (GNSS) have been developed to provide positioning information such as GPS, Galileo, Baidou, GLONASS. Availability of accurate position from GNSS is critical for safe operations.
Satellite-based navigation systems are however very vulnerable. In fact, satellite signals are very weak when reaching the earth and are therefore susceptible to interference and jamming. Cybersecurity threats such as spoofing are also a growing concern.

In a previous collaboration between Linköping University and ABB Corporate Research in Baden Switzerland and ABB Marine & Ports in Helsinki, Finland, we developed an algorithm to estimate the position of the own vessel by comparing the radar response of the navigation radar with digital elevation models. This approach provides a support and backup system to GNSS positioning that does not rely on any external infrastructure. More details can be found in GNSS-Free Maritime Navigation using Radar and Digital Elevation Models. The image below illustrates how radar detections overlaid on a simple model just having water and land as states. We can here estimate the position and orientation of our own vessel by fitting the reflections to the contour of the shore.

We now want to take this promising approach to new levels, by extending the method in different ways:

- Learn how the radar response from a given position at sea can be predicted from existing geographical information system.
- The radar response model can further be improved over time using machine learning approaches when more measurements from the same position become available.
- Use transponder data from other vessels to ignore their radar reflections, that otherwise would appear as model errors.
- As a by-product, other vessels without transponders can be detected

We are seeking highly motivated students interested to contribute in making maritime navigation safer! Experience with Python programming is necessary.

Details:

- Time period: January - June 2021
- Master thesis 30 ECTS for each student
- One student or two students working jointly
- Hiring manager Linus Thrybom, +46 21 32 36 09, linus.thrybom@se.abb.com
- Supervisor ABB, Alf Isaksson, alf.isaksson@se.abb.com
- Supervisor LiU, Professor Fredrik Gustafsson, fredrik.gustafsson@liu.se