SUMMARY OF THE MASTER'S THESIS

AUTOMATIC SHIP POSITIONING

In this master thesis, modelling of a small fisherman's ship, in three degrees of freedom, is presented. Stern propulsion, with limits on speed, angle and rate is used. Fluid influence on the ship is approximated by empirical formulas. *PID* and *backstepping* algorithms are developed to keep the ship on the perimeter of the circle and facing towards the centre, despite weather influences and currents. The analogy could be drawn to a pendulum in a gravitational force field. Coordinates of the circle centre and radius are provisional. Algorithms obtain information only from the course of the ship and its *GPS* location. Wave induced forces and state observer were not modelled. Differential equations are modelled in *Simulink* and visualisation is done by importing simulation results in *Matlab* workspace. By comparing the integral of absolute error of the ship's course, nonlinear control has shown its merits, but with more agile actuation.

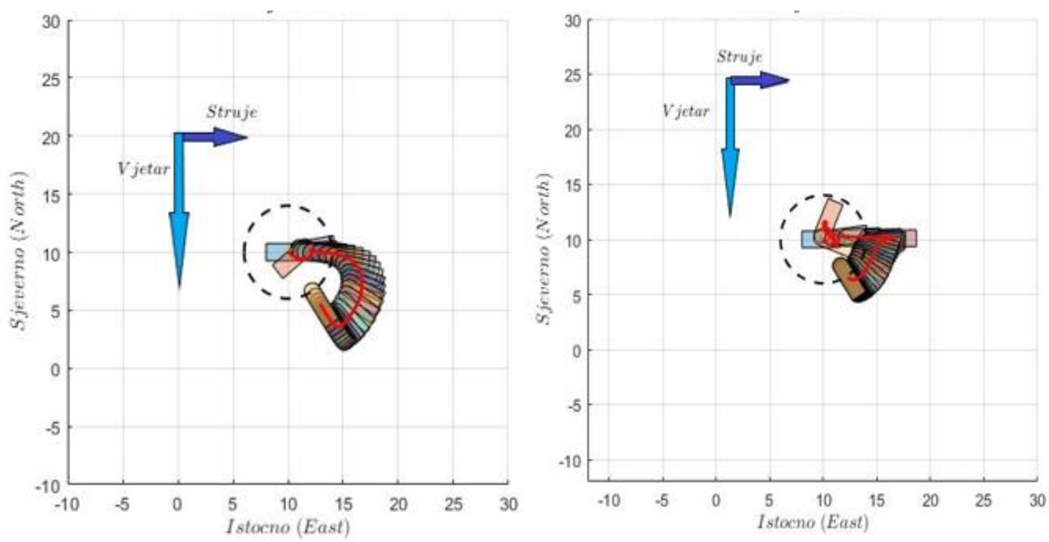

Image 1. Comparison between two developed algorithms for Weather optimal heading control (left image is the custom PID and right is backstepping). The ship is presented in North-East coordinates (in meters). The light blue arrow is the direction of the modelled wind forces and dark blue are the water currents (ramp functions with saturation).

MAIN REFERENCES:

- T.I. Fossen, Handbook of marine craft hydrodynamics and motion control, publisher John Wiley & Sons, place Chichester, West Sussex, Velika Britanija, 2011.
- T. I. Fossen, J. P. Strand, Nonlinear passive weather optimal positioning control (WOPC) system for ships and rigs: experimental results, Elsevier Automatica, 2000.
- M. Breivik, Ø. K. Kjerstad, Weather optimal positioning control for marine surface vessels, 8th IFAC Conference on Control Applications in Marine Systems, 2010.