

Control Tuning

The Balefire system uses the openSEA application openCMD to implement the individual degree of freedom control. Each degree of freedom has several states of control: open-loop, closed-loop tracking position, closed-loop tracking velocity, and closed-loop tracking a reference position. In most cases, the closed-loop controllers implement a classical control algorithm based on a modified Proportional-Integral-Derivative (PID) controller. As with any controller, the closed-loop controllers in Balefire need to be tuned to the physical plant, the input sensors, and to the particular actuators used to move the plant.

Tuning is done to enable optimum autopilot performance and requires changing parameter values in the configuration file for openCMD to suit your system. openCMD reads the configuration file on startup and sets the parameters for all controllers.

The dynamics of your particular vehicle dictate the values. Different vehicles have different masses, buoyancy, sensors, and thrusters, and those variables have a legitimate impact on gains. If you have an accurate hydrodynamic model of your system you can analytically determine the controller gains for a plant. If you don't, you have to use empirical methods to tune the vehicle (guess-and-test).

The Greensea Workspace provides a graphical utility to tune the controllers within the system. The graphical utility provides configuration screens for each separate controller with real-time displays of the commanded state, the current state, and the actuator efforts. Additionally, the utility provides access to the controller gains, several limits on the controller parameters, and functions to read and write the controller configuration.

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