



TECHNICAL NOTE  
**DYNAMIC POSITIONING SYSTEM**  
GAIN AND DAMP TUNING

2023-10-21



SCTN-DPSv40-0001-Gain and Damp Tuning

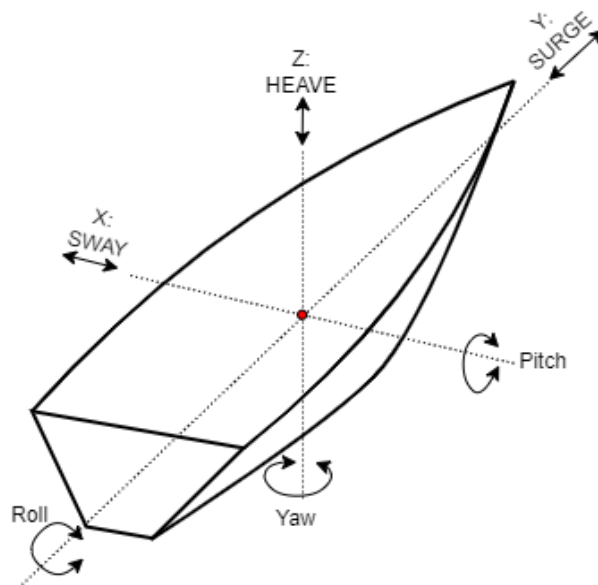
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## 1 Introduction

Tuning the Shipcontroller DPS controllers (Y-Surge, X-Sway, Z-Yaw) experimentally usually involves a trial and error process, seeking the best system response without instability.



*Remember that tuning a controller in a real-world environment, like a boat, involves considering safety first. It's always a good idea to have a mechanism to deactivate the controller or take manual control in case something goes wrong. It can also be helpful to have someone assist you in observing the boat's behavior while adjusting the controller.*



## 2. Tuning procedure

We recommend that you perform the DPS controllers tuning in this order:

1. Yaw axis (Z axis, heading).
2. Sway axis (Lateral movement, X axis).
3. Surge axis (Longitudinal movement, Y axis).

There are two parameters to adjust for each axis: Gain and Damp. Gain can vary between 1 and 100, and Damp can be adjusted between 0 and 250.

Here's a basic procedure to experimentally tune the X, Y, Z controllers for your boat:

1. **Initialization:**
  - Set the Damp to minimum (zero).
  - Increase the Gain from zero until you observe an acceptable system response. If the response is too slow, increase Gain. If you observe sustained oscillations or instability, decrease Gain.
2. **Adjusting the Gain:**
  - Slowly increase the Gain until the position error is reduced to an acceptable value or until the system begins to oscillate.
  - If the system oscillates, decrease Gain slightly until the oscillations are acceptable or disappear. This Gain value is your operating proportional gain.
3. **Adjusting the Damp:**
  - With Gain adjusted, slowly increase the Damp from zero.
  - Damp will help improve the response speed and will reduce any overshoot (if present). However, a Damp value that's too high can cause noise or instability.
  - Increase Damp until you see an improvement in the settling time or a reduction in the overshoot without introducing noise or instability. If the system starts to act erratically or becomes unstable, reduce Damp.
4. **Test under varied conditions:**
  - Once you've tuned the controller for a specific condition (like a particular type of wave or wind), it's important to test the boat under different conditions to ensure that the controller is robust and performs well in various scenarios.
5. **Iteration:**
  - You may need to adjust Gain and Damp several times to find the best combination for your system.
6. **Additional considerations:**
  - If you notice that the boat exhibits oscillatory behavior even with a low Damp value, you might need to check if the Gain value is too high or consider increasing the Damp value.
  - If the system responds too slowly despite having a high Damp value, you might need to increase Gain.
  - Controller tuning is a trade-off between response speed, overshoot, and stability.

