

Title: From the Automatic Control of Vessels Designed for Offshore Operating Conditions to the Automatic Control of Large Barge Convoys in a River/Canal: Lessons Learned

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Abstract

The waterway transportation sector, despite its problems and bottlenecks, is continually seeking alternatives to improve its operations. With goals of increased efficiency, safety and cost reduction, the sector is modernizing and acquiring new technology. The Dynamic Position control system for a large barge convoy is one of the new technology highlights. This innovation may make development in the Brazilian waterway transportation sector feasible by permitting navigational safety and greater flexibility in transport and distribution not only for mined products but for petroleum and its derivatives.

This paper presents the development process of The Dynamic Position control system for a large barge convoy in the Parana-Paraguay Rivers, for Rio Tinto Mining Company. The hydrodynamic effects in a river are quite different than those of the traditional offshore environment. The degree of difficulty involved in solving this problem is highly dependent on a ship's characteristics, which can be analyzed in terms of their hydrodynamic coefficients. Model tests in towing tanks were made to adjust the hydrodynamic coefficients and characteristics of the thrusters. The choice of the "Backstepping" control law and observer (state estimator) presented in this paper is a result of these particular conditions. The authors point out the advantage of using this technique, since all the properties of the hull, propeller and thruster coefficients have already been tested and tuned and make it possible to create a reliable set-up that optimizes navigation in restricted waterways.

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