J-STAGE

My J-STAGE Sign In

Journal of the Japan Society of Naval Architects and Ocean Engineers
The Japan Society of Naval Architects and Ocean Engineers

Available Volumes | Japanese >> Publisher Site

Author: ADVANCED Volume Page
Keyword: Search Go

Add to Favorite Articles | Add to Favorite Publications | Register Alerts | My J-STAGE HELP

TOP > Available Volumes > Table of Contents > Abstract

ONLINE ISSN : 1881-1760
PRINT ISSN : 1880-3717

Journal of the Japan Society of Naval Architects and Ocean Engineers
Vol. 8 (2008) pp.115-122

[PDF (600K)] [References]

Investigation on Broaching-to Using Optimal Control Theory

Atsuo Maki, Naoya Umeda and Seiya Ueno

(Accepted August 1, 2008)

Summary: Broaching-to is a phenomenon in which a ship cannot keep her desired course despite the maximum steering effort. Once this dangerous phenomenon happens, she could capsize due to violent yaw motion. Generally a PID autopilot, however, has been used in model experiments and numerical simulations for investigating broaching-to although PID auto-pilot does not properly represent the "maximum steering effort". This paper attempts to apply an optimal rudder control for a ship in following and quartering seas with high speed. We performed the numerical optimization of rudder control for higher speed region which includes surf-riding threshold,i.e. heteroclinic bifurcation point. To the trajectory optimization nonlinear programming method was applied in conjunction of the method based on calculus of variation, e.g. Sequential Conjugate Gradient-Restoration Algorithm (SCGRA). Numerical results indicate an example that a ship cannot prevent significant course deviation even with course keeping rudder control based on the optimal control theory. Calculation results also showed that the optimal rudder control during surf-riding takes opposite maximum value. As a result, it was concluded that if the yaw motion became unstable around stable equilibrium point, she could consequently face broaching-to in spite of rudder control process before a ship is surf-ridden.

[PDF (600K)] [References]

Download Meta of Article[Help]
RIS
BibTeX

To cite this article:
Atsuo Maki, Naoya Umeda and Seiya Ueno: Investigation on Broaching-to Using Optimal

Control Theory , Journal of the Japan Society of Naval Architects and Ocean Engineers, (2008), Vol. 8, pp.115-122 .

Copyright (c) 2009 The Japan Society of Naval Architects and Ocean Engineers

Japan Science and Technology Information Aggregator, Electronic