Fault Tolerant Position-mooring Control for Offshore Vessels

Fault-tolerance is crucial to maintain safety in offshore operations. The objective of this paper is to show how systematic analysis and design of fault-tolerance is conducted for a complex automation system, exemplified by thruster assisted Position-mooring. Using redundancy as required by classification societies’ class notations for offshore position controlled vessels, the paper shows how violations of normal behaviour of main components can be detected and isolated. Using a functional service philosophy, diagnosis procedures are auto-generated based on provable correct graph analysis methods. Functional faults that are only detectable, are rendered isolable through an active isolation approach. Once functional faults are isolated, they are handled by fault accommodation techniques to meet overall control objectives specified by class requirements. The paper illustrates the generic methodology by a system to handle faults in mooring lines, sensors or thrusters. Simulations and model basin experiments are carried out to validate the concept for scenarios with single or multiple faults. The results demonstrate that enhanced availability and safety are obtainable with this design approach. While methods are introduced at a tutorial level, the paper is original by providing a total Position-mooring system design that ensures resilience to any single fault and to selected multiple faults.

General information
Publication status: Published
Organisations: Department of Electrical Engineering, Automation and Control, Norwegian University of Science and Technology
Corresponding author: Blanke, M.
Contributors: Blanke, M., Nguyen, T. D.
Pages: 426–441
Publication date: 2018
Peer-reviewed: Yes

Publication information
Journal: Ocean Engineering
Volume: 148
ISSN (Print): 0029-8018
Ratings:
BFI (2018): BFI-level 1
Scopus rating (2018): CiteScore 3.6 SJR 1.28 SNIP 2.242
Web of Science (2018): Impact factor 2.73
Web of Science (2018): Indexed yes
Original language: English
Keywords: Safety, Fault-Tolerant Control, FPSO, Position-mooring, Active fault isolation, Fault diagnosis
DOI:
10.1016/j.oceaneng.2017.11.042
Source: PublicationPreSubmission
Source ID: 139481472
Research output: Contribution to journal › Journal article – Annual report year: 2018 › Research › peer-review