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Ali, M.A.H.[a] , Radzak, M.S.A.[b] , Mailah, M.[c] , Yusoff, N.[a] , Razak, B.A.[a] , Karim, M.S.A.[a] , Ameen, W.[d] , Jabbar, W.A.[e] , Alsewari, A.A.[f] , Rassem, T.H.[f] , Nasser, A.B.[f] , Abdulghafor, R.[g]

A novel inertia moment estimation algorithm collaborated with Active Force Control scheme for wheeled mobile robot control in constrained environments

(2021) *Expert Systems with Applications*, 183, art. no. 115454, .

DOI: 10.1016/j.eswa.2021.115454

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Abstract
This paper presents a novel inertia moment estimation algorithm to enable the Active Force Control Scheme for tracking a wheeled mobile robot (WMR) effectively in a specific trajectory within constrained environments such as on roads or in factories. This algorithm, also known as laser simulator logic, has the capability to estimate the inertia moment of the AFC-controller when the robot is moving in a pre-planned path with the presence of noisy measurements. The estimation is accomplished by calculating the membership function based on the experts' views in any form (symmetric or non-symmetric) with lowly or highly overlapped linguistic variables. A new Proportional-Derivative Active Force Controller (PD-AFC-LS-QC), employing the use of laser simulator logic and quick compensation loop, has been developed in this paper to robustly reject the noise and disturbances. This controller has three feedback control loops, namely, internal, external and quick compensation loops to compensate effectively the disturbances in the constrained environments. A simulation and experimental studies on WMR path control in two kinds of environments; namely, zigzag and highly curved terrains, were conducted to verify the proposed algorithm and controller which was then compared with other existed control schemes. The results of the simulation and experimental works show the capability of the proposed algorithms and the controller to robustly move the WMR in the constrained environments.

Author Keywords
Active force control (AFC); Laser simulator logic (LSL); Noisy and constraint environment; Wheeled mobile robot (WMR)

Index Keywords
Computer circuits, Controllers, Force control, Membership functions, Simulators; Active force control, Control schemes, Estimation algorithm, Inertia moment, Laser simulator logic, Laser simulators, Moment estimation, Noisy and constraint environment, Wheeled mobile robot; Mobile robots

Funding details
Universiti MalayaUMFP039-2018A
Universiti Malaysia PahangRDU1803138, RDU180323, RDU190804

The authors disclosed receipt of following financial support for the research, authorship, and/or publication of this article: This research was sponsored by Ministry of High Education-Malaysia (MOHE), Universiti Malaya (UM) with grant No. FP039-2018A and Universiti Malaysia Pahang (UMP) with grants No: RDU180323, RDU1803138 and RDU190804.

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Publisher: Elsevier Ltd

ISSN: 09574174
CODEN: ESAPE
Language of Original Document: English
Abbreviated Source Title: Expert Sys Appl
2-s2.0-85108641414
Document Type: Article
Publication Stage: Final
Source: Scopus