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2022 The 37th ICROS Annual Conference (ICROS 2022)

일시: 2022년 6월 22일(수)~24일(금) 장소: 거제 소노캄

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(사)제어·로봇·시스템학회에서 매년 주최 및 주관하는 국내학술대회인 「2022 제37회 제어·로봇·시스템학회 학술대회」가 2022년 6월 22일 (수)부터 24일(금)까지 거제 소노캄에서 개최됩니다.
4차 산업혁명을 주도할 제어, 로봇 및 시스템 분야의 최신 연구개발 동향을 공유하며 연구자간에 상호교류 할 수 있는 자리를 마련하였으니 많은 관심과 참여를 부탁드립니다.

논문모집안내

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논문제출안내

2022년 4월 22일(금)	논문 접수 마감일
2022년 5월 20일(금)	세션 일정 공지
2022년 5월 27일(금)	발표자 사전등록 마감일

제출방법

소정의 논문양식(홈페이지 참고)에 따라 2페이지로 온라인 제출 (요약문 제출 및 심사과정 생략)

초청세션 구성 및 논문

세션당 논문 5~6편을 모집 후 소정의 구성양식(홈페이지 참고)을 작성하여 논문 접수 마감일까지 사무국 이메일로 제출, 논문은 온라인 제출

- 제출논문은 본 학술대회에 처음 발표되는 것으로 한정
- 국·영문으로 모두 작성 가능
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- 우수논문에 대한 시상 및 ICROS 논문지(한국연구재단 및 SCOPUS 등재지) 게재 추천

특별 프로그램

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- 우수신진연구자 초청발표
- 응용 논문 발표 및 데모 세션
- 산학포럼: 산업체에 필요한 제어·자동화·로봇·인공지능
- 학부생 논문 경진대회 (포스터 발표) :
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Lyapunov Pose Controller for 4 Wheel Independent Steering and Driving System

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Abstract The revised input should be crucial for the controlling the 4 wheel independent mobile robot in uneven terrain. In this paper, the Lyapunov position controller is utilized in order to extract the revised input which are linear and angular velocities signals. In order to track the reference trajectories precisely using 4 WIS(Wheel independent steering), the application of the revised input into the real interface is introduced. On the other side of the research, the interface between 4 wheel mobile platform and MATLAB/SIMULINK was developed and manufactured for real experimental purpose by Chonnam National University, Agricultural Robotics and Automation System. Finally, simulation and experiments are conducted to prove the effectiveness of the method

Keywords 4 WIS(Wheel independent steering), MATLAB/SIMULINK interface, Closed-loop position controller, conversion from units

1. The development of 4 wheel independent steering interface

This section presents the method described in [1], corresponding application of the 4 WIS(wheel independent steering) are denoted in [2]-[5].

The overall interface for 4 wheel independents steering is given in Fig. 1.

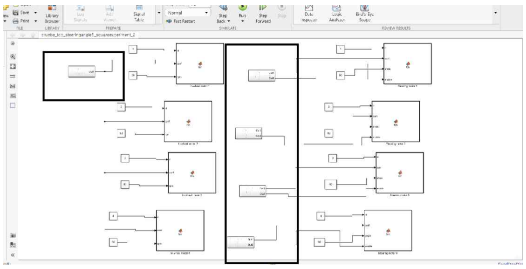

Fig 1. The interface between SIMULINK and 4 steering , 4 in-wheel motors

The left four MATLAB functions are connected into 4 steering motors of 4 WIS. On the other hand, the right four MATLAB functions are into 4 in-wheel motors of 4 WIS.

※ This work was supported by the Defence Acquisition Program Administration (DAPA) (21-SF-GU-01) and the Korea Institute of Planning and Evaluation for Technology in Food, Agriculture, Forestry (IPET)(12102902).

The left subsystem and right subsystem are designed with the cascaded step functions depending on the input shaping relevant to the mobile robot's movement: move forward and backward, right turn and left turn.

2. Extension of the Closed Loop Position Control

In this section, a position controller is designed for the 4WIS denoted by the reference : [1]. The controller consists of an industrial laptop with TCPIP communication.

Proposition 1 : The open loop system modeling is developed by the equation (1), (2), (3) which are denoted in [1].

$$\begin{bmatrix} e_1 \\ e_2 \\ e_3 \\ e_4 \end{bmatrix} = \begin{vmatrix} \cos(\theta_A) & \sin(\theta_A) & 0\,0 \\ -\sin(\theta_A) & \cos(\theta_A) & 0\,0 \\ 0\,0 & & 1\,0 \\ 0\,0 & & 0\,1 \end{vmatrix} \begin{bmatrix} e_1 \\ e_2 \\ e_3 \\ e_4 \end{bmatrix} \tag{1}$$

$$U = \begin{bmatrix} \theta_A \\ \dot{\theta}_A \\ \dot{\beta}_A \end{bmatrix} = \begin{bmatrix} -K_1 e_1 + V_R \cos(e_3) \\ \dot{\theta}_R - e_2 K_2 v_R - K_3 \sin(e_3) \\ \dot{\beta}_R - K_4 e_4 \end{bmatrix} \tag{2}$$

$$
\begin{bmatrix} \dot{X}_A \\ \dot{Y}_A \\ \dot{\theta}_A \\ \dot{\beta}_A \end{bmatrix} = \begin{bmatrix} v_A \cos(\theta_A + \beta_A) \\ v_A \sin(\theta_A + \beta_A) \\ \dot{\theta}_A \\ \dot{\beta}_A \end{bmatrix} \tag{3}
$$

If we cascaded three equations, it is open loop system ■

The overall structure of the open loop system and feedback controller is designed in SIMULINK given as in Fig. 2.

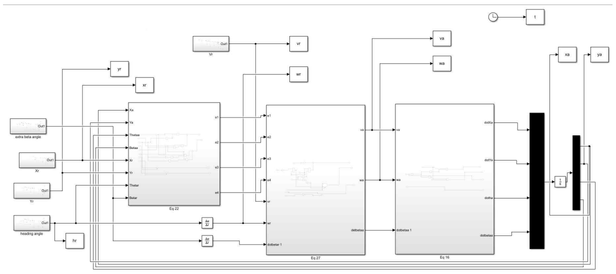

Fig. 2. The overal structure of the Lyapunov Position controller Deisign in SIMULINK

From (1), (2), (3) the corresponding SIMULINK designs are inside of three subsystems. In this SIMULINK, the parallel structure explained in [1] are simulated for the square path following simulation, the corresponding result is described in Fig. 3.

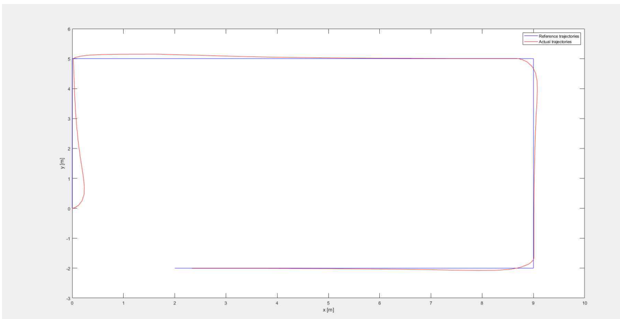

Fig. 3. The Following of Reference path with Actual path

The red line is output using revised input of the Lypunov position controller. The blue line is the reference trajectories pre-designed in terms of cascaded step functions. The red line follows blue line within the 5 cm RMSE(root mean square error) which shows the validity of the proposed method.

3. Incorporation of the Closed-loop control into the platform's interface

This section introduces how the lyapunov method is connected into the previously designed interface structure.

The Lyapunov position controller denoted in Fig. 2 is inserted into the subsystem denoted in Fig. 4. The conversion from m/s to radian is simply multiplied by 9,54 for rpm from m/s, 57.29578 for degrees from rad/s. The following gain blocks denoted in black box in Fig. 4 is designed for each multiplier in order to convert the corresponding units.

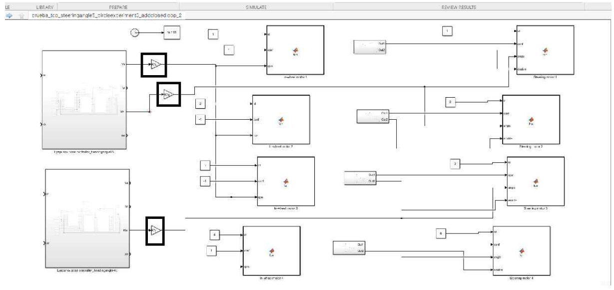

Fig. 4. Corresponding closed loop SIMULINK block diagram.

4. Conclusion

In the paper, the validity of the position controller are demonstrated through SIMULATION. In the future, the method is applied to the real agricultural environment.

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