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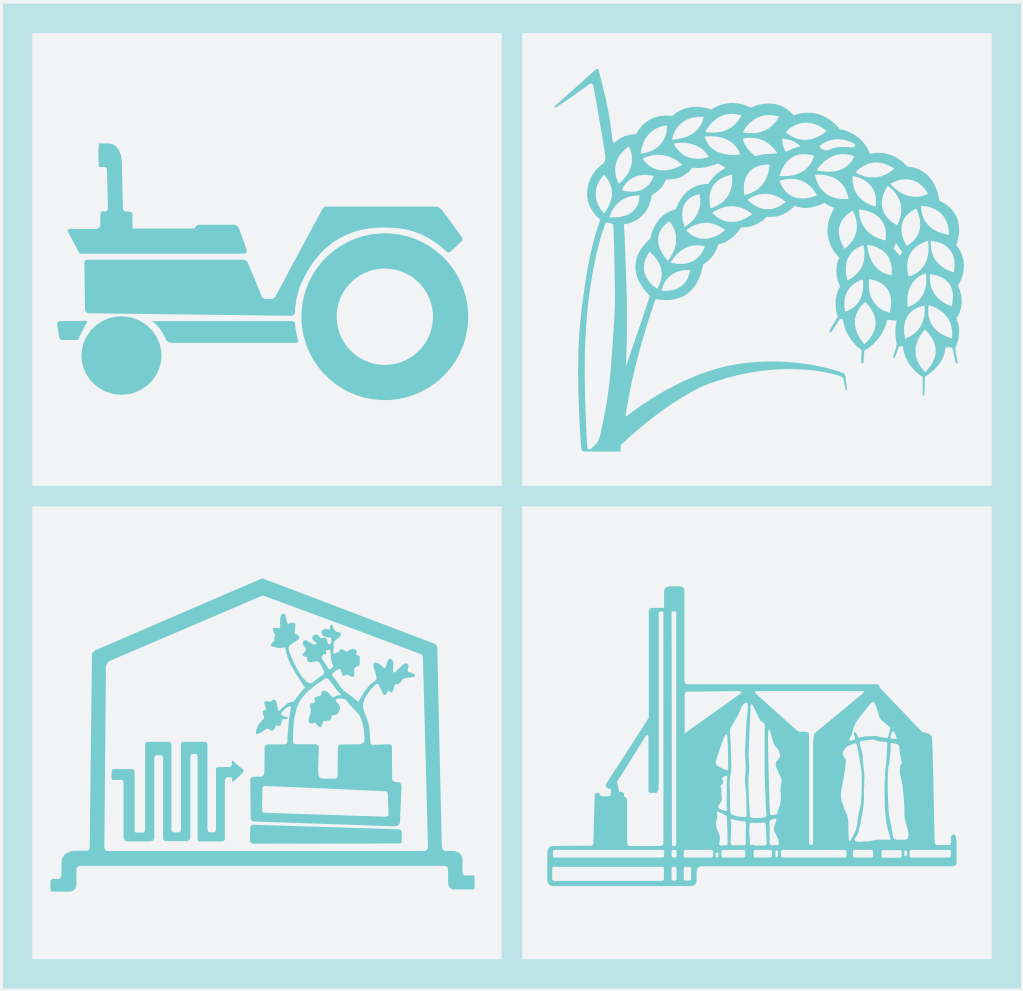

주최

(사) 한국농업기계학회
KSAM Korean Society for Agricultural Machinery

스마트팜 연구센터
Smart Farm Research Center

KSAM 2023 Autumn Conference

한국농업기계학회 구두발표 일정

GRB 1 ▶노외기계시스템 및 정밀농업 I

■ 좌장 : 남주석 교수 (강원대학교) ■

9:00~9:12	5	**Analysis of Engine Power Requirement According to Agricultural Operations of 100 kW-class Tractor** Hyeon-Ho Jeon(Chungnam National University), Seung-Yun Baek, Mo-A Son, Young-Joo Kim*
9:12~9:24	6	**1D/3D 시뮬레이션을 활용한 농용 트랙터 싱크로나이저의 열-온도 해석** Thermal-Temperature Analysis of Synchronizer of Agricultural Tractor using 1D/3D Simulation 김재승(한국기계연구원)*, 문상곤, 최재훈, 이동건, 김수철
9:24~9:36	7	**Precision Balance Control of Agricultural Transport Platform Using 3-PRS Parallel Mechanism** Andong Huang(Chonnam National University), Woo-Young Kim, Kyeong-Hwan Lee*
9:36~9:48	8	**Analysis of power transmission system for 55 kW electric tractor** Seung-Min Baek(Chungnam National University), Min-Jong Park, Jong-Dae Park, Yong-Joo Kim*
9:48~10:00	9	**Application of APS (auto power shift) controller for selecting suitable engine mode based on fuel consumption during major operations** Md. Abu Ayub Siddique(Chungnam National University), Seung-Yun Baek, Seung-Min Baek, Yong-Joo Kim*
10:00~10:12	10	**ISO 11783 규칙 기반의 공간정보센서 표현 시뮬레이션** Simulation of spatial information sensor representation based on ISO 11783 specification 임을균(한국전자통신연구원)*, 조현규
10:12~10:24	11	**씨눈 인식을 위한 인공지능 모델 및 씨감자 자동절단장치 개발** Development of artificial intelligence model for embryo recognition and automatic seed potatoes cutting device 임금재(전남대학교), 김선종, 오주선*
10:24~10:36	12	**구동부 및 PTO 레이아웃에 따른 55kW급 전기구동 트랙터의 용량 분석** Power System Capacity Analysis of 55kW Electric Tractors based on Powertrain and PTO layouts 김경대(한국생산기술연구원), 이시영, 박영준, 김원균*
10:36~10:48	13	**농업용 로봇의 새머리 선회 알고리즘 개발을 위한 시뮬레이션 연구** Simulation Study to Develop Headland Turning Algorithm for Agricultural Robots 김용현(서울대학교), 윤창호, 윤철환, 김학진*
10:48~11:00	14	**농업용 트랙터 변속기의 소음 저감을 위한 시험-해석적 연구** Simulation and Experimental Analysis for reduce noise in agricultural tractor transmissions 문상곤(한국기계연구원), 최재훈, 김재승, 김수철*
11:00~11:10		**Break Time**

Precision Balance Control of Agricultural Transport Platform Using 3-PRS Parallel Mechanism

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Abstract

To alleviate the workload of farmers, transport robot platforms have been deployed in the agricultural field. However, when traversing inclined or bumpy terrains, existing robot transport platforms struggle to maintain the stability of the transported goods. To tackle this challenge, we introduced a balance control system based on a 3-PRS parallel mechanism aimed at ensuring cargo stability. We utilized ADAMS and Matlab Simulink for joint simulation. Through ADAMS, we established the kinematic model of the 3-PRS parallel mechanism and input parameters such as the current angle and height of the platform into Matlab Simulink. After computing the kinematic inverse solution of the 3-PRS parallel mechanism, we employed PID control to ensure precise control, successfully simulating the maintenance of balance by the 3-PRS parallel stabilized platform during motion. To validate our approach, we installed an IMU on the actual robot platform to collect the current platform angle, utilized ROS for data communication, and realized the balance control system in reality. Our system achieved a maximum control angle of 12° on both the x and y axes, with a balance error of 0.08°. This indicates that our system can maintain balance on terrains with a slope not exceeding 12°, keeping the balance error within 0.08°, and achieving full balance within 1.1 seconds. Overall, our research presents a robust agricultural robot transport platform capable of maintaining cargo stability on inclined and bumpy terrains, significantly reducing the burden on farmers while greatly enhancing the reliability of agricultural transportation.

Keywords

balance control, 3-PRS mechanism, PID, Inverse Kinematics.

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