

# TEACHING SEMINAR

## A Fundamental Principle in Kinematics: Basic Kinematic Equation

Wednesday, March 20, 2024 1:10 pm - 2:00 pm  
ARMS B061

### Zehui Lu

Visiting Assistant Professor Candidate

#### ABSTRACT

Kinematics describes motions without considering the causes of motion. The fundamental concepts and principles of kinematics can be applied to various engineering problems, such as robotics, navigation, and aeromechanics. One such application is simultaneous localization and mapping (SLAM) in surface vehicles or quadruped robots, where integrating perceived data with platform motion is crucial for accurate perception.

This teaching demonstration aims to revisit the foundational principles of kinematics, focusing on rectilinear, rotational, and planar motion through two illustrative examples: projectile motion and circular motion. Additionally, a simpler representation of the circular motion is illustrated by using polar coordinates. This representation unveils the Basic Kinematic Equation (BKE), a powerful tool that relates motion as observed in a rotating reference frame to its equivalent motion in a non-rotating inertia reference frame.

#### BIOGRAPHY

Zehui Lu is currently working toward a Ph.D. degree in Aeronautics and Astronautics Engineering at Purdue University and doing a research internship at Mitsubishi Electric Research Laboratories. He received an M.S. degree in Mechanical Engineering from the University of Michigan in 2019. He was a Research Engineer with UM Ford Center for Autonomous Vehicles before he started his Ph.D. program. His current research interests include autonomous, distributed, and optimization-based decision-making, and how to apply these techniques to the planning and control of multi-robot systems and multi-physical systems. His recent work focuses on the co-design of electric vehicles and (mobile) manipulators, battery energy management, precision motion control, and real-time collision-aware motion planning.