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DEPARTMENT OF BIOMEDICAL ENGINEERING

ROBOTICS AND AUTOMATION IN MEDICINE

III Year : VI Semester

TITLE: DYNAMIC STABILIZATION

An Introduction Dynamic Stability in Robotics

This presentation explores the dynamic stabilization concept in robotics, focusing on how it enhances stability and performance. We will delve into its applications and benefits in various robotic systems.

Dynamic stabilization leverages advanced algorithms to continuously adjust the robot's balance and posture in response to external forces. This results in improved stability and agility, vital for complex tasks.

Enhancing Stability in Robotics

Dynamic stabilization plays a crucial role in enhancing stability by effectively countering disturbances and maintaining equilibrium, enabling robots to perform tasks with precision and confidence.

The integration of dynamic stabilization significantly enhances performance by enabling robots to execute dynamic movements with greater accuracy and speed, leading to improved efficiency and productivity

DYNAMIC STABILITY

A fundamental difference between locomotion mechanisms is whether they are statically or dynamically stable. A statically stable mechanism will not fall even when all of its joints freeze (Figure 2.2.1, left). A dynamically stable robot instead requires constant motion to prevent it from falling.

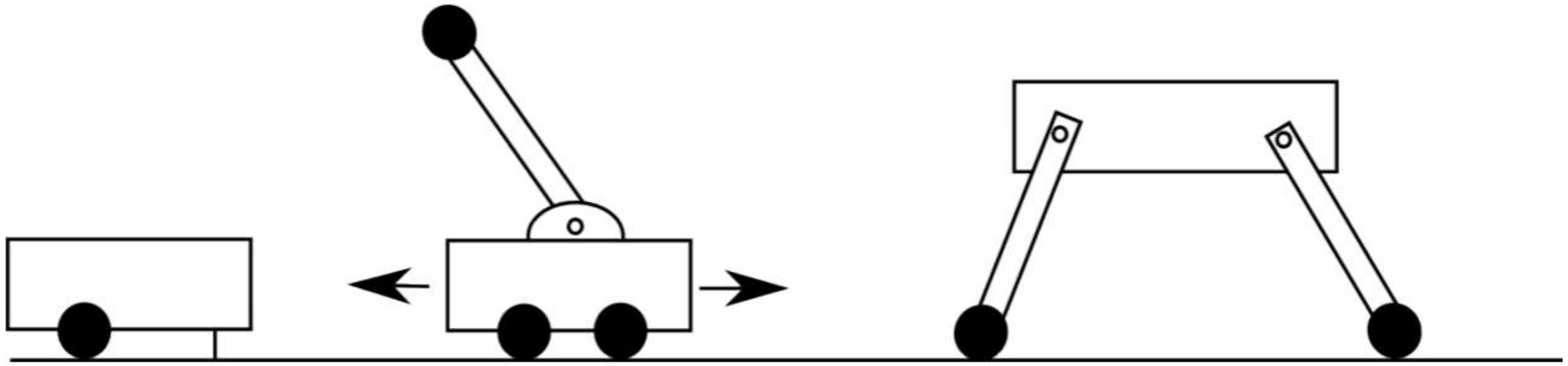
Technically, stability requires the robot to keep its center of mass to fall within the polygon spanned by its ground-contact points. For example a quadruped robot's feet span a rectangle. Once such a robot lifts one of its feet, this rectangle becomes a triangle.

If the projection of the center of mass of the robot along the direction of gravity is outside of this triangle, the robot will fall.

DYNAMIC STABILITY

A dynamically stable robot can overcome this problem by changing its configuration so rapidly that a fall is prevented. An example of a purely dynamically stable robot is an inverted pendulum on a cart (Figure 2.2.1, middle)..

Such a robot has no statically stable configurations and needs to keep moving all the time to keep the pendulum upright. While dynamic stability is desirable for high-speed, agile motions, robots should be designed so that they can easily switch into a statically stable configuration (Figure 2.2.1, right)



APPLICATION IN ROBOTICS

Dynamic stabilization finds diverse applications across various robotic domains, including industrial automation, medical robotics, and autonomous vehicles, revolutionizing their capabilities and safety.

While dynamic stabilization offers numerous benefits, there are challenges such as computational complexity and real-time responsiveness. Ongoing innovations are addressing these challenges to further advance the technology.

FUTURE PROSPECTS

The future of dynamic stabilization in robotics is promising, with advancements in AI, sensor technology, and control systems. This paves the way for even more sophisticated and versatile robotic platforms.

CONCLUSION :

Dynamic stabilization is a game-changer In robotics, offering unparalleled stability and performance. Its widespread adoption across industries and ongoing advancements ensure a future of highly capable and agile robots.


Thank you