Universitatea „Lucian Blaga” din Sibiu

INTERNATIONAL EXHIBITION OF INVENTIONS INNOVATIONS "TRAIAN VUIA" TIMISOARA

UNIVERSITATEA LUCIAN BLAGA DIN SIBIU

HYBRID-ARCHITECTURE MECANUM WHEEL WITH INDEPENDENTLY ACTUATED ROLLERS

Patent request in progress

Emanuel BALC, Aurel Mihail TITU, Daniel BALC, Stefan TITU

DESCRIPTION

In practice, we encounter the following problems:

Lack of Active Traction Control at Roller Level

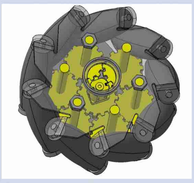
Conventional Mecanum wheels rely on passive rollers that rotate freely without any independent actuation. While this allows for omnidirectional movement, it also limits the ability to manage traction dynamically at each contact point with the ground. In environments with uneven grip — such as mixed surfaces (e.g., one wheel on asphalt, another on sand or wet tiles) — the inability to modulate traction per roller leads to inconsistent motion, slippage, or loss of directional control. Active control at the roller level would allow the system to respond more intelligently to such variations, improving overall traction and stability.

Limitations in Precision Maneuvers and Active Stabilization

Without active roller control, Mecanum wheels cannot perform complex maneuvers such as automatic slip compensation, platform stabilization, or dynamic adaptation to local obstacles.

THE PROPOSED SOLUTION

This Mecanum wheel represents a significant technological advancement by integrating an independent actuation system for the peripheral rollers. In traditional configurations, Mecanum wheel rollers are passive, rotating freely as the main wheel spins. In this hybrid wheel, each roller is equipped with its own actuation system, powered by a dedicated DC micro-motor capable of independently controlling the roller’s speed and direction of rotation.



RESULTS AND DISCUSSIONS

- *Active Traction Control at Each Roller*
- *Advanced Maneuverability and Increased Precision*
- *Improved Energy Efficiency*

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MODULAR MECANUM WHEEL ASSEMBLY OPTIMIZED FOR TRACTION ON SANDY AND UNSTABLE SURFACES

Patent request in progress

Aurel Mihail TITU, Daniel BALC, Emanuel BALC, Stefan TITU

DESCRIPTION

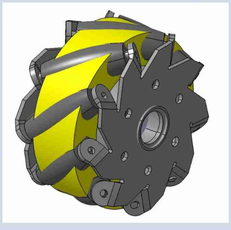
In practice, we encounter the following problems:

Difficulties in moving on unstable surfaces

Vehicles equipped with Mecanum wheels face significant challenges on surfaces such as sand, gravel, or soft soil.
These terrains do not provide firm support, leading to traction loss and difficulties in maintaining the desired direction.
Omnidirectional mobility, a major advantage of Mecanum wheels on hard surfaces, becomes inefficient when ground contact is unstable.

THE PROPOSED SOLUTION

This modular Mecanum wheel is specifically designed to ensure advanced mobility on low-traction surfaces or terrains that are traditionally challenging for this type of wheels, such as sand, gravel, or soft surfaces.



CONCLUSIONS AND DISCUSSIONS

- *Improved Traction*
- *Reduced Sinking*
- *Energy Efficiency*
- *Adaptability & Durability*

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MECANUM WHEEL WITH INDIVIDUAL FLEXRING-EQUIPPED ROLLERS FOR VIBRATION DAMPING AND ENHANCED STABILITY

Patent request in progress

Daniel BALC, Aurel Mihail TITU, Emanuel BALC, Stefan TITU

DESCRIPTION

In practice, we encounter the following problems:

Excessive Vibrations During Movement

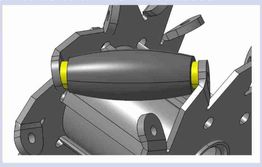
On hard surfaces (such as concrete or metal) and uneven terrain, Mecanum wheels make intermittent contact with the ground, as each roller touches the surface one at a time. This discontinuous interaction generates constant vibrations that propagate throughout the entire mobile platform. In applications that require smooth motion.

Direct Transmission of Shocks to the Structure and Electronics

Without a damping system at the roller level, mechanical shocks and vibrations caused by ground contact are transmitted directly to the vehicle’s supporting structure. This can negatively impact the lifespan of electronic components (such as motherboards, microcontrollers, or sensors) and may lead to malfunctions caused by high-frequency vibrations. In autonomous systems, these shocks can destabilize control and navigation algorithms.

THE PROPOSED SOLUTION

This Mecanum wheel incorporates a damping component, based on the use of flexrings mounted on each individual roller. Flexrings are flexible structures that absorb vibrations generated by the rollers' contact with the rolling surface. This adaptation brings multiple benefits, especially for precision applications such as industrial robots or autonomous vehicles operating in vibration-prone environments or on uneven surfaces.



RESULTS AND DISCUSSIONS

- *Significant Vibration Reduction*
- *Extended Lifespan of Wheels and Components*
- *Reduced Operational Noise*

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