



Tilting tricycle with user-controllable stability

OTT ID #1626

TECHNOLOGY

A tilting, narrow-track, recumbent tricycle with *variable stability* combines the of best upright bikes, recumbent bikes, and recumbent trikes to eliminate the drawbacks of each and avoid the pitfalls of other existing tilting trikes.



Many riders and would-be riders **currently struggle** with:

- Ergonomics of upright bikes
- Balancing and maneuvering recumbent bikes
- Wide tracks, low seating, or jarring sustain tilt of rigid recumbent trikes

Problems with existing tilting trikes:

- The parallelogram linkage is at least as **complex** as the swing arm and bell crank linkage but does not provide the inherent suspension feature or folding feature.
- **Springs are either too soft** to provide static stability **or too stiff** to allow free tilting necessary for easy cornering.
- Tilt locks are binary, either off or on, and provide **no way to right a lean**.
- Active control requires the **added weight, complexity, and expense** of a power source, actuators, sensors, and a controller.

Benefits of new novel tilting trike

- **Narrow track** which reduces pavement requirements and air drag.
- **Eases fore/aft center of mass location requirements** so the rider no longer needs to be position between a pair of wheels for lateral stability.
- **Reduces side loads on frame, wheels, and tires** which reduces strength and stiffness (i.e. weight) requirements, reducing rolling resistance and tire wear in corners.
- **Ergonomic:**
 - ❖ **Eliminates need for low center of mass** so the rider can sit up high to improve visibility, also facilitating entry and exit from seat.
 - ❖ **Eliminates undesirable sudden or steady-state tilting** caused by road crown or uneven pavement (dropping a wheel off the pavement onto the gravel below is no longer a scary event).
 - ❖ **Eliminates side loads on rider** caused by lateral acceleration in a turn.
 - ❖ **Provides static stability** when slow or stopped.
- **More Fun** for the rider by providing the enjoyable experience of leaning into a turn.
- **More Options** by providing the possibility to be fully faired for protection against weather and dramatically reducing the power required to overcome air drag.
- **Allows rider to tune stability** by allowing the rider to make the trike as statically stable as a rigid trike, as free-tilting as a bike, and anywhere between these two extremes.



Technology Overview



INTELLECTUAL PROPERTY

Provisional Patent Application filed Winter 2019.

This award-winning technology (“Innovation Award” at ASME’s HPVC hosted by Michigan State University, April 5-7, 2019 and First Place, Undergraduate at UWM’s CEAS Engineering Research Poster Competition, April 27, 2019) is part of an active and ongoing research program and is seeking partners to develop more of the final product. It is available for developmental research support/licensing under either exclusive or non-exclusive terms.

Tilting Trike with Variable Stability demo ride at University of Wisconsin-Milwaukee
<https://youtu.be/aTCDq5CXnck>

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Dr. Andrew Dressel teaches mechanics at the University of Wisconsin-Milwaukee in the departments of Mechanical and Civil Engineering. He is director of the UWM Bicycle and Motorcycle Engineering Research Laboratory, and he has been investigating the dynamics of narrow-track vehicles since 2002.

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