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Design of an Innovative Steering Mechanism for Tilting Three-Wheel Motorcycles

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Abstract: *In regular vehicles, the wheels turn when you steer — straightforward and what we're all used to. But with some newer types, like tilting trike, it works differently. Instead of just turning the wheels, the whole vehicle leans into the curve, kind of like what happens when you're riding a bike or a motorcycle. We found this concept interesting, especially since companies like Toyota and Harley-Davidson are working on it. Tilting gives a few big advantages — it helps the vehicle stay stable in turns, makes it less likely to skid, and lets you take sharper corners. But there's a catch*
— tilting doesn't really help much when the vehicle is going slow. At lower speeds, the lean just isn't strong enough to keep things stable, and honestly, it can feel a bit awkward or even unsafe.
That got us thinking. What if we didn't have to pick just one system? Maybe there's a way to mix both tilting and traditional turning. The idea was to take the good parts of each and see if we could make them work together, so the vehicle handles better no matter what speed it's going. As part of developing this hybrid steering setup, we also made sure it wasn't just about how it worked on paper — it needed to be strong, safe, and reliable in real-world use. To check this, Finite Element Analysis (FEA) was used to test how different parts of the steering mechanism would hold up under various loads and stresses. This helped us refine the design, improve weak points, and confirm that the final mechanism could handle actual driving conditions without compromising safety or performance.

Keywords: Tilting Mechanism, Three-Wheel Motorcycle, Steering Geometry, Vehicle Dynamics, Lean-to-Steer System

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