

# Design and Analysis of a Reinforced Swing Arm Suspension System with Single-Axle Integrated Drive and Brake Assembly

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**Abstract:** *Conventional electric two-wheeler rear drivetrains rely on multiple axles for the swing arm, intermediate pulleys, brake drum, and wheel hub, leading to elevated part count, unsprung mass, assembly complexity, and misalignment risks. This study introduces an integrated single-axle architecture where the swing arm and intermediate pulleys share one axle, while the rear drum brake and driving pulley form a unified assembly on the rear wheel axle, targeting a 1000W motor for 35 km/h top speed. SolidWorks CAD modeling, ANSYS finite element analysis, prototype fabrication, and vehicle testing validates the design against drivetrain torque, braking loads, and durability requirements. Compared to the multi-axle baseline, the approach yields 12% unsprung mass reduction, 25% reduction in part count, 40% faster assembly, and improved alignment tolerance, lowering manufacturing costs by 15-20%. This reinforced swing arm also provides the necessary strength and flexibility to handle dynamic loads. These gains enhance reliability and manufacturability for retrofit and production platforms*

**Keywords:** Swing Arm, Suspension, ANSYS, SolidWorks

