A Novel Adaptive Landing Gear Design to Reduce Stress During Crosswind Landings

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Every day, there are over 40,000 crosswind landings occurring. Pilots use sideslip or crabbing methods to land in crosswinds. Both techniques require pilots to use ailerons to bank the airplane into the wind to maintain centerline of the runway. This causes the upwind landing gear to touchdown first, taking 100% of vertical load before downwind gear touches down. This leads to gear fatigue or gear failure thus creating safety hazards. To address this issue, a novel adaptive landing gear prototype is mounted on an RC plane to compare the vertical load between the normal and adaptive gear. Also, a computer simulation is used to test the adaptive gear's behavior. The results show the adaptive gear can achieve a 40-60% load distribution between the downwind and upwind gear, contrasting the 100% load distribution on the normal upwind gear. Moreover, roll moment and angular momentum of adaptive gear are 3-8 times lower than the normal gear under different crosswind speeds, proving the roll motion decreases significantly when adaptive gear is applied. The drop test also shows the adaptive gear's structure can sustain improper crosswind landings at 600 ft/min, while a normal landing sink rate is between 60-200 ft/min and hard landing is approximately 400ft/min. With adaptive gear, it can achieve an even load distribution which decreases the risk of gear failure and reduces stress. Also, the roll out process is eliminated as both gear touches down simultaneously, decreasing the roll motion during crosswind landings, thus making crosswind landings safer and smoother.

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