

Rancang Bangun Stairlift dengan Sistem Keselamatan Darurat Multi-Pulley Braking = Design and Development of a Stairlift with an Emergency Multi-Pulley Braking System

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Abstrak

Stairlift merupakan solusi transportasi vertikal bagi individu dengan keterbatasan mobilitas, terutama dalam menavigasi tangga rumah. Salah satu aspek paling krusial dalam sistem ini adalah fitur keselamatan, khususnya pada kondisi darurat seperti kegagalan penggerak utama. Penelitian ini merancang dan membangun prototipe stairlift yang dilengkapi dengan sistem pengereman darurat berbasis multi-pulley, yang bertujuan untuk memperlambat penurunan bebas seatframe secara mekanis tanpa intervensi aktif. Proses penelitian meliputi desain mekanik, analisis tegangan dan defleksi, manufaktur, serta pengujian kecepatan dan percepatan penurunan seatframe dalam kondisi free-fall. Hasil menunjukkan bahwa sistem pengereman bekerja optimal pada tegangan tali antara 300–400 N dan mampu menjaga kecepatan turun tetap dalam batas aman. Faktor keamanan struktur berada di atas ambang batas minimum, serta sistem anti-derailment berhasil mencegah seatframe keluar dari rel. Prototipe ini menunjukkan potensi untuk dikembangkan lebih lanjut sebagai solusi keselamatan pasif pada stairlift.

.....Stairlifts serve as a vertical transportation solution for individuals with limited mobility, particularly in navigating staircases within residential environments. One of the most critical aspects of such systems is the safety mechanism, especially in emergency situations involving primary drive system failure. This study presents the design and development of a stairlift prototype equipped with a passive emergency braking system based on a multi-pulley configuration. The objective of this system is to decelerate the seatframe during free-fall conditions through mechanical means, without requiring active intervention. The research process encompasses mechanical design, stress and deflection analysis, manufacturing, and experimental testing of seatframe velocity and acceleration during free-fall scenarios. The results indicate that the braking system performs optimally at cable tensions between 300–400 N, effectively maintaining descent velocity within safe limits. Structural safety factors exceed the minimum threshold, and the integrated anti-derailment mechanism successfully prevents the seatframe from disengaging from the guide rail. This prototype demonstrates significant potential for further development as a passive safety solution in stairlift systems.