Automatically Engaging Skateboard Brake

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Abstract

When riders fall off their skateboards, the runaway skateboard can be a hazard to bystanders and roll away a significant distance. The purpose of this design is to prevent these problems by developing an automatic braking system using strain gauges, a circuit and a braking mechanism to stop the board after the rider has fallen off. Testing showed that the design greatly reduced the distance traveled by the runaway board.

Analysis

Locations for the strain gauges were determined by finding the maximum displacement on the bottom of the board. This displacement, which is related to strain by $\varepsilon = \Delta L / L$ (1), was determined using finite element analysis (Figure 3a). The stress profile simulated in Figure 3b was as a result of applying a force of 0.22 lbs to the tip of brake.

The circuit consists of a Wheatstone bridge and comparator. The Wheatstone bridge is used to relate changes in strain to voltage drop. This voltage is sent to the comparator to start the brake motor when the weight on the board is less than 90 lb (40.8 kg).

The motor is connected to a gear box with a ratio of 344:1 designed to amplify the torque going to the gear rail. When the rail extends, it pushes the brake pad against the wheel to stop the skateboard.

Results and Conclusion

In tests of a skateboard traveling at 6.36 mph, the device reduced the stopping distance by 73.2% and stopping time by 81.5% (Graph 1). The braking system effectively stopped the runaway skateboard and successfully met the performance requirements. Thus, a safer environment was created for the rider and bystanders.

Testing

To test how effectively the brake worked, a comparison was required between the skateboard with and without the automatic braking system. The testing process was:

1. The idle speed of the car was determined (to be used later in testing).
2. Without the brake system on, the skateboard was released from the car while traveling at idle speed.
3. The stopping time and distance traveled were recorded for five trials.
4. Steps 2 and 3 were repeated with the braking system on.

Table 1. Performance Requirements for Prototype

<table>
<thead>
<tr>
<th>Requirements</th>
<th>Quantity</th>
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</thead>
<tbody>
<tr>
<td>Stopping Time</td>
<td>2-3 seconds</td>
</tr>
<tr>
<td>Travel Distance</td>
<td>8 feet</td>
</tr>
<tr>
<td>Max User Weight</td>
<td>250 pounds</td>
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<tr>
<td>Max Stopping Speed</td>
<td>15 mph</td>
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<tr>
<td>Skateboard Length</td>
<td>2-4 feet</td>
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</tbody>
</table>

References

Existing Products: Brakeboard and Pogo-Board

Acknowledgements

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