Rover wheel assistive grouser shape effects on traction force in flat soft terrain

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ABSTRACT

This paper presents the study of different grouser shapes on the performance of the assistive grouser wheel travelling on a flat surface loose soil terrain. This work is an extension from our previous work exploring the rover wheel assistive grouser angle of attack effects on traction force in soft terrain. Therefore, a new experiment involving the different grouser shapes on the assistive grouser wheel must be conducted to comprehend the interactions between the grouser and loose soil. From observation, the bulldozing effect of the assistive grouser is also influenced by the grouser shapes. Further understanding of the soil flow also effect of the grouser shape design in general. Hence, we have developed 4 different grouser shapes to be attached to the single wheel rover testbed to evaluate the effects of the shape to the performance of the assistive grouser wheel on a 0-degree slope loose soil surface. The grouser shapes consisted of Inverse Parallel, C-Shape, Inverse C-Shape and Inverse Chevron Shape. The average total traction force and current consumption was examined. It was observed during the grouser entering the sand surface, the sand piled up onto the grouser surface effecting the value of average total traction force. This was caused by surface area of the grouser. The more surface area of the assistive grouser, the more traction force generated to push the wheel forward. Based on the experimental results, it was concluded that Inverse Parallel is the optimal grouser design for use as assistive grouser in wheeled rover on soft sand, as it has the lowest surface area and the lowest average total traction force. However, Inverse Chevron generated the least current consumption by the half-wheel rover. These results indicate that the traction force of the assistive grouser is not affected by shape, but the width and depth of the assistive grouser.

KEYWORDS

Assistive grouser; Robot mobility; Robotics; Soft terrain; Tractive performance

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