# Rover wheel assistive grouser angle of attack effects on traction force in soft terrain

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**ABSTRACT**

This paper presents the effects of different grouser angle of attacks on the traction performance of an assistive grouser wheel traversing on soft sandy terrain. This work is an extension from our previous work on assistive grousers attached to a rover wheel to improve performance on soft terrain, where traversing and climbing performance for wheeled rover is improved on steep slopes up to 30-degrees by using assistive grousers rather than conventional fixed grousers. Thus, new experiment correlated with the assistive grouser must be developed for further understanding of the sand-grouser interaction. It was observed that the performance of assistive grousers to reduce sinkage and generate forward traction is influenced by the assistive grousers angle of attack, shape and size. Consequently, for this study we developed a single wheel rover testbed to measure the effects of grouser angle of attack on traction force generated. Grouser attack angles that were experimented are 0,10,20,30 and 40-degrees, on a 0-degree slope sand surface. It was observed that during a grouser's movement, there are instances where a forward and backward traction was generated depending on the position of the grouser during wheel rotation. This was hypothesized to be caused by the imbalance in traction generation by the inner and outer side of the grouser, and also due to the variance in traction force generation by multiple grousers moving under the sand surface at the same time with different speed due to geometric constraints of the assistive grouser horizontal movement. It was concluded that for 0-degree slope, a 0-degree angle of attack is the most effective, and there is considerable effect of using multiple grousers and distance from the wheel on grouser traction generation. Results indicate that the shape of the grouser could increase the effectiveness of the grouser for a future study.

**KEYWORDS**

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

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