Effects of Wheel Grouser Angle of Attack on Simulated Robot Wheel Performance on Soft Sand with High Slip Condition

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ABSTRACT

Wheeled rover which is a lightweight wheeled robot is used for navigating over challenging terrain such as a steep soft sand incline. To improve the performance of the wheels on soft surfaces, the wheels are usually equipped with fixed grousers (lugs) on its wheels. However, even with the grousers the wheels tend to experience high slippage and sinks into the soft sand surface, which is caused by the rotating motion of the grousers which excavates the sand underneath the wheel towards the back of the wheel. A solution has been proposed by previous research which reduces sand movement and subsequent sinkage by using a prototype angle adjustable grouser mechanism and proven to improve the rover performance on steep inclines. The purpose of this study is to investigate the effect of grouser angle of attack when moving under the sand surface, towards the interaction between the grouser and sand particle. For the simulation process, Discrete Element Method (DEM) is used to simulate the particle-particle and particle-grouser interaction. The result shows that maintaining a constant angle using the adjustable grouser is able to reduce the amount of sand being excavated from under the wheel towards the back of the wheel as tests in high slipping conditions shows less displacement of sand particles from under the wheel towards the surface of the wheel. The result will be used to assist in analyzing the optimal parameters for wheel grouser design for use on soft sand.

KEYWORDS

Fixed grousers, wheel rover; soft sand surface

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