Numerical Simulation of Rigid Wheel Running Behavior on Sand Terrain

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The complex running behavior of rigid wheel on sand terrain is simulated by 3D coupled discrete and finite element method(FE-DEM) based on soil-bin experiment. First, 3D spherical discrete elements(DE) are randomly generated in a specific area with radius value in a given size range to describe the sand terrain, the DE are compacted to a stable state under self-weight to simulate the real sand state. Then, the rigid wheel which is described by finite elements(FE) sinks on to sand terrain surface under the action of external vertical load and self-weight until an equilibrium state is reached. After that, a constant angular velocity and corresponding translation velocity are added to the wheel to investigate the running behavior under different slip ratio conditions. The tractive performance parameters such as net draw bar pull and sinkage are expressed, and the simulation results are compared with current soil-bin experiment results to verify the effectiveness of the method.

Key words: FE-DEM, Rigid wheel, Running behavior, Sand terrain