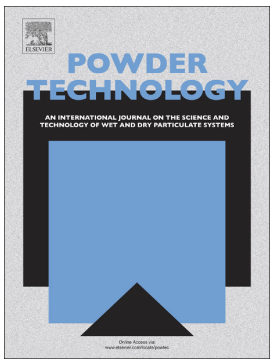

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Effect of packing fraction on dynamic characteristics of granular materials under oblique impact

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Abstract: The rheological properties and dynamic behaviors of granular media under oblique impact are very sensitive to the variation of packing fraction. In this work, granular beds with different packing fraction have been obtained by changing the mixture ratio and diameter ratio of two components. Then, the influence of packing fraction on the dynamic characteristics of the two-dimensional granular beds subjected to oblique impact has been investigated using the discrete element method. Simulation results exhibit that there exists a critical packing fraction for the reversal of the penetration depth-packing fraction dependence. The linear relationship of horizontal penetration depth and impact velocity is still remained, but vertical penetration depth and impact velocity is held at the expense of correlation coefficient. However, if the packing fraction exceeds the critical domain of packing fraction, the resistance force cannot be decomposed into two independent functions proportional to the square of velocity and depth any more for impact angles larger than the critical angle, vice versa. Meanwhile, the dependence of stopping time on the impact velocity exhibits a criticality characteristic when packing fraction is in the critical range, that is, for an impact angle lower than critical angle, the stopping time generally increases linearly with impact velocity, while it decreases in an exponential manner for a larger impact angle. Based on the simulation results, the scaling relations between penetration depth, stopping time and packing fraction, impact angle have been proposed. Meanwhile, a phenomenological model describing the resistance force has been established considering the

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