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CFD-DEM simulation of large particle behaviour in slurry pumps: effect of outlet orientation

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In this study the wear behavior of a slurry pump is investigated using CFD-DEM approaches with particular interest in the damage caused by large particle transport. A mixture model to capture the transport of the slurry fines is combined with a DEM model for larger particle transport, and specifically in the 25 mm diameter range. Of particular interest is the effect of large particles on surface damage and how the pump orientation influences damage behaviour. To account for the lack of understanding of the damage behavior in the literature, damage metrics have been created from particle surface interaction properties calculated using the DEM model and accounts for two potentially different mechanisms; direct particle impact damage and abrasive damage. The damage mechanism is then used to assess the relative damage across different elements of the pump and specifically to assess the effect of pump orientation and the important influence of gravitational effects in pumping slurries. The modeling approach will be outlined and the basis of the metrics will be explained. The results indicate that when transporting large particles, significant changes in damage behaviour can be expected by simply reorientating the pump outlet from a top horizontal to a bottom horizontal configuration. The predicted magnitude of these effects are presented for different geometrical features of the pump.