

Flexible Bodies for Investigation of Chip Jamming and Drill Breakage in Deep-Hole Drilling

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ABSTRACT

The risk of chip jamming and thereby caused breakage of the drill is a major concern for deep-hole drilling mostly by long-shaped chips. While a twist drill acts as an Archimedean screw, which supports besides the transport of the cutting fluid also the transport of the chips, the single-lip drill (SLD) has only a single straight flute for the chip evacuation [1]. Therefore, the cutting-fluid flow and the chip shape have a major influence on the process reliability.

In previous works [2,3], the transient process of chip evacuation for deep-hole drilling was modeled by a coupled SPH-DEM simulation. The cutting fluid was modeled by SPH, whereas the chips, the drill, and the borehole were modeled by DEM. However, the chips were assumed to be rigid, which showed to be a good starting point for the modeling of the cutting-fluid flow and the chip evacuation. In reality, the chips have a rather low stiffness due to their small thickness and are thereby highly flexible.

For a first investigation of the chip jamming a virtual barrier is added, which is permeable for the fluid but blocks the chips from their further evacuation as shown in Figure 1. Further, the deformation of the chips and the drill have to be included in the modeling for a better understanding of the process of chip jamming itself and the occurring forces. The aim of this contribution is to present some progress for modeling flexible bodies in the process of deep-hole drilling and their usage for the investigation of chip jamming and drill breakage.

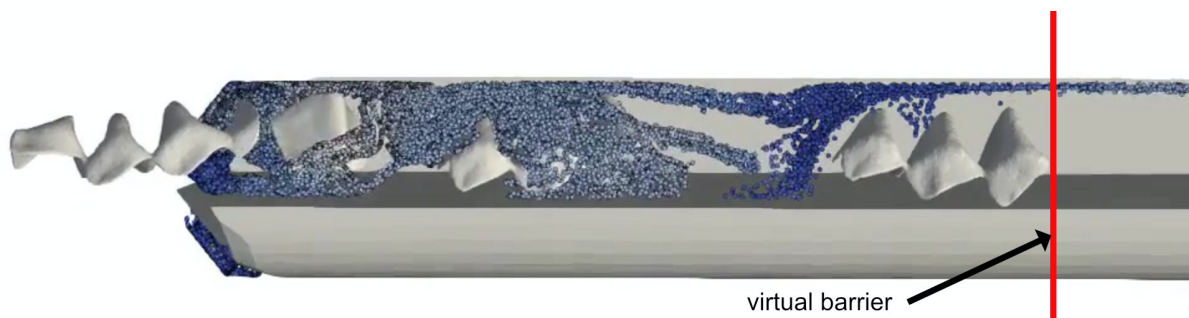


Fig. 1 Chip evacuation under the influence of cutting fluid for a single-lip drill with a virtual barrier for investigation of chip jamming

REFERENCES

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