

MODELLING AND SIMULATION OF DUST PARTICLE TRANSPORT IN DRILL BITS USING THE DISCRETE ELEMENT METHOD (DEM)

General

- Almost every construction activity creates dust, e.g.: sawing, drilling, grinding, breaking
- Hilti's dust removal systems tackle dust as it is being produced in order to minimize dust exposure and to maximize tool performance

Problem Description

- Transport of concrete drilling dust particles in boreholes driven by the helix of the drill bit
 - Production of high amount of dust and fragments during drilling process
 - Spherical & non-spherical particle shapes
 - Particle agglomeration due to cement moisture
 - Close link between the drilling performance and the dust transport capacity of the drill bit
 - High volume dust removal prolongs the bit's lifetime, e.g., due to less wear and less heating

Benefits

- Basic knowledge on the dynamics of the dust particles during transport process
- Prediction of the dust transport efficiency of helix designs in the development phase

Objective & Tasks

- Evaluation and recommendation of mechanical models for dust transport simulation in drill bit applications
- Numerical calibration of model input parameters / material properties
- Evaluation and assessment of the Coarse Graining Approach (CGA) for the use cases
- Deriving of recommendations for enhanced drill bit design

Required Skills

- Basics in particle mechanics
- Basics in the Discrete Element Method
- Experiences in DEM analyses
- Independent working style

Drill Bit Application Examples



TE-CX (SDS PLUS)



TE-Y (SDS MAX)

[Image sources: www.hilti.group]