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Numerical investigations of cohesive granular material using an annular geometry

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In-depth analyses of sheared cohesive granular material have been performed using distinct element methods. A two dimensional geometry of a coaxial rheometer was used to investigate the shearing of cohesive granular material suffering constant radial loading. The investigated geometry has been chosen according to previous in situ snow experiments with a large scale coaxial rheometer.
For the numerical investigation velocity and stress profiles are measured throughout the sheared particle assembly for varying cohesive forces and rotational speeds. Cohesive forces are described by a dimensionless number eta. Mean tangent velocity profiles for low cohesive particle entities (eta typically lower than 0.5) can be approximated with a logarithmic model. Introducing higher cohesions the velocity profile can be divided into a strongly sheared layer at the bottom and a quasi static regime above with lower values of the tangent velocity. This quasi static layer is characterized by bumps in the mean velocity profile and a notable increase of velocity fluctuation is observed. Furthermore it can be shown, that the highly sheared layer is becoming thinner when increasing cohesion.