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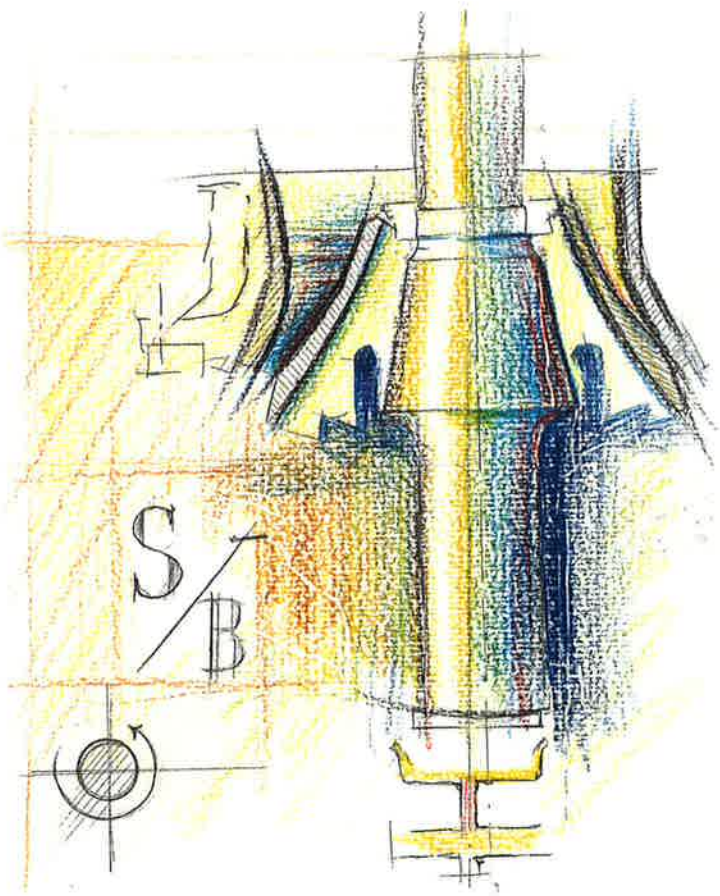

Cone Crusher Performance

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CONE CRUSHER PERFORMANCE

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ABSTRACT

Cone crushers are used by both the aggregate producing and the mining industry. Both industries are interested in increasing the product quality while at the same time lowering the production costs. Prediction of crusher performance has been focused on, since crushing is a vital process for both industries.

In this thesis a method for prediction of cone crusher performance is presented. The model is based on the laws of mechanics and constitutive relations concerning rock breakage characteristics. There are some crucial assumptions which are of central interest for the model. The validity of these assumptions has been verified by full-scale tests.

The overall size reduction process is a result of several subsequent crushing events. Therefore, the process occurring in a cone crusher must also be modelled in the same repetitive way. Each crushing event is modelled with a selection and a breakage function. Selection corresponds to the probability of a particle being broken when an aggregate of particles is compressed. Breakage represents the way a single particle is broken into smaller fragments.

The appearance of the selection and breakage functions is rock material specific and can be obtained by laboratory tests. The characterization of the fragmentation behaviour for rock materials is done by form conditioned compression crushing tests. Two modes of breakage are possible to achieve in a cone crusher. The location of the choke level is the criterion which determines the breakage mode. Interparticle breakage is achieved above the choke level while only single particle breakage is achieved below this level.

The crusher model takes the fragmentation behaviour of the rock and feed size distribution into consideration. Moreover, chamber and machine geometry, together with machine parameters such as closed side setting, stroke and eccentric speed, is accounted for. On all occasions continuity of mass is preserved.

Three *main factors* are identified to promote the size reduction process occurring in a cone crusher. These factors are: breakage modes, number of crushing zones, and compression ratio. The main factors are affected by both design and operating parameters. For a given crusher, the factors depend on eccentric speed, closed side setting, rock material breakage characteristics and feed size distribution. The main factors provide a fundamental and detailed understanding of how a cone crusher operates. Any design consideration should be evaluated against these main factors.

The model can be used as a simulation tool to assist in the design process of crushers. Any arbitrary design can then be studied. If a set of simulations is performed for a given crusher, a *Crusher Performance Map* is achieved, which in turn can be used when optimizing a given crushing task or a crushing plant.

Keywords: aggregates, comminution, crushing, mining, modelling, particle size, simulation, size-reduction.

CONTENTS

Appended Papers

Paper A: Prediction of Size Distributions from Compressing Crusher Machines
Paper B: Investigation of Interparticle Breakage as Applied to Cone Crushing
Paper C: Output Prediction of Cone Crushers
Paper D: Modelling of Flow in Cone Crushers
Paper E: Size Reduction in Cone Crushers