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ANNOUNCEMENT MASTER THESIS

The Chair of Mining Engineering and Mineral Economics is announcing three master theses in cooperation with a rock engineering specialist from KGHM CUPRUM R&D, Poland:

1. Analysis of the impact of detonation velocity on the range of the crack zone around the blast hole

Aim of the thesis

The main objective of this thesis is to determine how the detonation velocity of bulk emulsion explosives affects the extent of the fracture zone in the vicinity of the blast hole. The analysis will be performed based on dynamic numerical simulations using hybrid computational methods. The results of the work will be the basis for improving the effectiveness of drilling and blasting patterns.

Description

Currently, drilling and blasting patterns are designed using simple analytical relationships or based on empirical observations using a trial-and-error approach. The use of numerical tools may be the basis for introducing improvements in blasting process by optimizing the spacing of blast holes and potentially minimizing the required explosives charge. As part of this study:

- The distribution of detonation velocities of bulk emulsion explosives will be analyzed depending on the type of rocks, method of initiation, blast hole diameter and rock mass temperature.
- Detonation pressures for minimum, maximum and average detonation velocities will be determined.
- A series of numerical calculations will be performed in a dynamic load system aimed at determining the extent of the fracture zone after the detonation of explosive material in blast holes.
- The optimal spacing of blast holes will be determined depending on the extent of the fracture zone.

Requirements

Relevant studies, i.e. mining engineering and rock mechanics, basic knowledge about FEM and FDEM numerical modeling.

Timing

To start as soon as possible with finalization of the work planned for Mar / Apr 2025.

Contact

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2. Impact of detonation velocity on detonation pressure in light of analytical calculations

Aim of the thesis

The main objective of this thesis is to determine the extent of the fracture zone generated by the detonation of explosives using information about the actual values of detonation velocities of various types of explosives recorded in in-situ conditions. The use of real data instead of data provided by manufacturers will increase the accuracy of calculations and may be the basis for increasing the efficiency of planning blasting works using simple analytical tools.

Description

As part of the thesis, it is planned to:

- Perform a statistical analysis of the detonation velocity of bulk emulsion explosives, packaged emulsion explosives and dynamite in in-situ conditions.
- Carry out a literature review regarding the estimation of the extent of the crack zone based on analytical formulas.
- Make a series of calculations using selected analytical approaches.
- Compare the results of the crack zone extent in the light of actual measurement data and the detonation velocity values declared by the manufacturer.

Requirements

Relevant studies, i.e. mining engineering and rock mechanics, basic knowledge about blasting technology.

Timing

To start as soon as possible with finalization of the work planned for Mar / Apr 2025.

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3. Determining the relationship between the magnitude of displacements and stresses in the slope depending on the dominant frequency of seismic vibrations.

Aim of the thesis

The main objective of this thesis is to analyze the influence of the dominant frequency of seismic vibrations on the stability of earth dams in the light of numerical calculations. The results of the analysis will enable obtaining comprehensive knowledge on the behavior of geotechnical objects under dynamic load conditions and will be the basis for determining the relationship between the amplitude-frequency characteristics of vibrations and slope stability.

Description

As part of the thesis, it is planned to:

- Analyze the parameters of induced and natural seismicity in terms of vibration amplitudes and frequencies recorded on selected geotechnical objects.
- Prepare different variants of computational models taking into account different geometries and strength parameters of the materials building the slope
- Performing a series of numerical simulations using FEM-based computational methods
- Conducting a risk assessment for the analyzed slopes
- Determining the validity of taking into account the frequencies of dominant seismic vibrations in regular stability loads of geotechnical objects

Requirements

Relevant studies, i.e. mining engineering and rock mechanics, basic knowledge FEM-based numerical modelling, basic knowledge about slope stability calculations.

Timing

To start as soon as possible with finalization of the work planned for Mar / Apr 2025.

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