Title: Smooth blasting by delayed blasting technique

Author(s): Wong, Chea Hao

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Smooth Blasting by Delayed Blasting Technique

Introduction
Smooth blasting has become important in underground excavation and tunneling to ensure that there is no excessive overbreak and remaining rock damage. This is due to the high cost of structural support in repairing blasted tunnels and the use of remaining rock as marketable products. In this experiment, we look into the effect of blasting delay because the effects remain unclear in the industry.

Objective
To achieve smooth blasting by using time lag between charge holes.

Methodology
Discontinuous Deformation Analysis (DDA) by plastic failure is adopted. Simultaneous blasting and delayed blasting with interval of 50μs between each charge hole are simulated and compared. The experiment focuses on interaction between stress waves from the three charge holes.

Discussion
In the case of simultaneous blasting, stress waves are generated from the charge holes at the same time. The strong impulse quickly produces intensive cracking around the holes before the cracks meet and join together. On the other hand, in delayed blasting, stress wave from the firstly initiated hole has sufficient time to propagate to the adjacent hole. When two stress waves meet, interference occurs. Destructive interference can be utilised to control overbreak.

Future Work
When stress wave reaches the free surface, it gets reflected. The reflected wave will then collide with the outgoing wave. The interaction of stress waves will result in different cracking pattern.