Vibration Reduction of Pneumatic Rock Drill for Rock Face Stabilization Sector

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Rock face stabilization in Norway
Background

- Rock face stabilisation is necessary to prevent rocks from falling on people and infrastructure
- Pneumatic rock drills used with high vibration exposure
- Ergonomically challenging
- Heavy dust exposure

Pneumatic rock drills are also frequently used in construction of powerline, tunnelling and blasting work.
Initial measurements

- Montabert T18 is commonly used when climbing, 20 kg
- Operator creates feed force by a hoist lever during drilling
- ISO 5349-1 vibration:
  - Drill handle 35-41 m/s²
  - Hoist lever 25-41 m/s²

Test in granite quarry

Hoist lever
Modifications – Montabert T18

- Montabert T18
- Vibration isolated handle
- Dust remover
- ATVA (Auto Tuning Vibration Absorber)
- Spring isolator
- Hoist

Original machine
1: Hoist chain spring-damper

- Hoist handle attached to the solid rock and isolated from the vibrating machine
- Stabilises feed force and increases productivity
- Vibration reduction on hoist handle with 80%, 27 m/s² => 6 m/s²
- Reduces the machine vibration approx. 30%
- 5 prototypes being tested
2: Vibration isolated handle

• The vibration on the handle is dominated by the drilling direction
• Handle on a lever arm
• Two torsional isolators connect the lever arm to the baseplate
  • Maximise isolation in drilling direction without sacrificing controllability
• Vibration reduction machine handle, approx. 60%, 37m/s² => 16 m/s²
• 5 prototypes being tested
3: Auto-Tuning Vibration Absorber (ATVA)

- ATVA auxiliary mass with nonlinear springs creates a counter force to the piston
  - Tuned to the operating frequency
  - Nonlinearity increases the effective frequency range

- Large potential for weight reduction
- Vibration reduction approx. 80% in axial reduction
- One prototype built
3: ATVA - Uses the machine vibration and creating a force
4: Dust control - Project spin-off

- Uses exhaust air to create ejector suction around drill hole and redirects dust from the operator
- Eased drilling start by drill guidance
- Noise reduction from machine exhaust outlet
- 5 prototypes being tested
Test of dust reduction

Before

After
Summary

- Vibration reduction total:
  - Machine handle: 67%, 37 to 12 m/s²
  - Hoist handle: 80%, 27 to 5.4 m/s²
- Reduced drill dust exposure
- Potential weight reduction with ATVA

Results can be significantly improved if implemented in new designs from the beginning!

New project will start this fall continuing the development😊
Come on now!
You can do better! Why has nothing happened the last 60 years with these machines???