DESIGN OF A TEST BENCH TO EVALUATE THE VIBRATION EMISSION VALUES OF JACKLEG ROCK DRILLS

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Introduction

Jackleg rock drills are widely used in the mining industry and are known to generate high levels of hand-arm vibration which contribute to the development of the hand-arm vibration syndrome for exposed miners.[1-3] To reduce the vibration levels, a prototype of an antivibration handle was developed as part of a previous study.[4] To provide some bench marking for this handle prototype and to follow the evolution of its performance over time, a test bench was developed to characterize the vibration emission values of jackleg drills under controlled operating conditions. As the current ISO 8662 series of standards could not apply directly to this type of tool, there was a need to design and validate a test bench to evaluate the vibration emission values of jackleg drills, while taking into account the conditions specific to the operation of this type of tool.

Methods

A test bench including an energy absorber, was developed for testing jackleg drills based on the ISO 8662-3 standard [5]. The energy absorber was bolted to a 3300 kg concrete block to ensure tool stability. A pictorial view of the device is given in Figure 1. For validation purposes, acceleration measurements at the handle of a conventional jackleg drill were taken simultaneously along the three axes (x_h, y_h and z_h) in an underground rock drilling operation as well as on the test bench. The handle accelerations were measured for three different jackleg angles (13º, 28º and 43º) determined with respect to the floor. Moreover, each measurement was repeated at least three times to asses the data repeatability.

Figure 5. Jackleg drill (right) with the energy absorber (left)

Results

As a preliminary validation of the test bench, Figure 2 provides a comparison of the frequency weighted rms acceleration spectrum measured along the z_h-axis, for both underground drilling and operation on the test bench (28º jackleg angle in both cases). It is shown that the vibration measured on the handle of a jackleg drill operating on the test bench is representative of that recorded during typical rock drilling operations, despite the fact that some harmonics of the percussion frequencies are generated with a higher amplitude on the test bench. Table 1 provides

a comparison of the overall frequency-weighted rms accelerations measured for all three jackleg angles. It is shown that the test bench provides comparable values of overall acceleration for all three axes, with much lower variation coefficients (COV) on the test bench, suggesting a higher measurement repeatability. In addition, it was verified that the measurements obtained on the test bench were reproducible, by ensuring that similar frequency-weighted rms accelerations could be obtained after completely reinstalling the jackleg drill on the test bench.

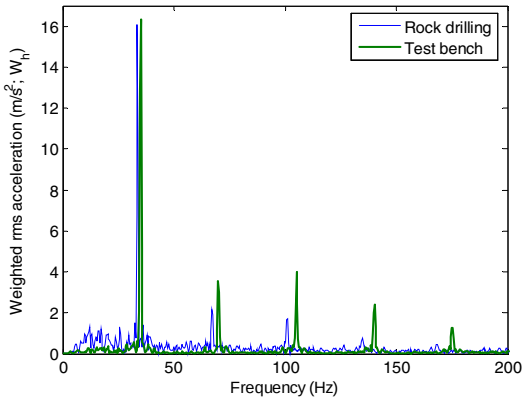

Figure 2. Comparison of vibration frequency spectrum measured on the test bench and while drilling (z_h percussion axis)

Table 1. Comparison of frequency weighted rms accelerations measured for three different jackleg angles on the test bench and while drilling.
m/s^2 (w_h)
COV (%)

		x axis	y axis	z axis	Total
13 deg	Bench	**10.66** 0.84	**5.33** 5.33	**20.72** 1.72	**23.90** 1.41
	Drilling	**12.80** 44.19	**6.18** 2.21	**24.30** 3.52	**28.41** 11.69
28 deg	Bench	**9.51** 1.98	**5.15** 2.03	**19.90** 0.79	**22.65** 0.73
	Drilling	**9.64** 8.96	**6.18** 29.70	**22.70** 13.13	**25.44** 13.33
43 deg	Bench	**11.46** 1.32	**5.52** 0.54	**18.74** 0.48	**22.65** 0.60
	Drilling	**8.78** 11.62	**4.92** 7.27	**19.73** 6.73	**22.16** 7.35

Discussion

The validation of a test bench to characterize the vibration emission values of jackleg rock drills has been presented. Preliminary results have shown that the test bench provides a good representation of the vibration measured during rock drilling operations, while providing a better repeatability of the acceleration values. Thus the test bench appears to be applicable to characterize the vibration emission values of jackleg drills.

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