The use of simulations to identify operational improvements on deep level mine compressed air systems

Brandon Friedenstein

February 16, 2017

Abstract

Contents

Abstract								
List of symbols								
A	crony	vms	vi					
\mathbf{G}	lossa	ry	vii					
1	Intr	oduction and background	1					
	1.1	Preamble	1					
	1.2	Background on compressed air in deep level mining	1					
		1.2.1 Mining profitability	1					
		1.2.2 Mining systems and energy usage	1					
		1.2.3 Need to reduce inefficiencies and improve service deliveries	1					
	1.3	Mining compressed air systems	1					
		1.3.1 Characteristic inefficiencies	1					
		1.3.2 Inefficiency identification methods	1					
		1.3.3 Instrumentation and measurements	1					
	1.4	Use of simulation in industry	1					
	1.5	Problem statement	1					
	1.6	Dissertation overview	1					
2	Literature study 2							
_	2.1	Preamble	2					
	2.2	Inefficiency identification methods	2					
	2.3	Review of operational improvements implemented in compressed air systems	2					
	2.4	Use of simulation to identify improvements in mining systems	2					
	2.5	Conclusion	2					
3	Dev	reloping a simulation methodology	3					
	3.1	Preamble	3					
	3.2	Investigation	3					
		3.2.1 Layouts, Data from SCADA Instrumentation, etc	3					
		3.2.2 Manual measurements, audits and approximations	3					
		3.2.3 Mining schedule philosophies - (drilling, blasting shifts, etc.)	3					
	3.3	Model development and verification	3					
		3.3.1 Compressed air component models	3					
		3.3.2 Simulation inputs	3					
		3 3 3 verification of model	3					

	3.4	Implementation of method	3					
	3.5	Analyses of data	3					
	3.6	Quantifying operational improvements	3					
	3.7		3					
4	Vali	dation of Results	4					
		4.0.1 Preamble	4					
	4.1		4					
			4					
			4					
		· · ·	4					
		· -	4					
	4.2	Case study: Mine B (Tshepong)	4					
		4.2.1 Background	4					
		4.2.2 Scenario 1	4					
		4.2.3 Scenario 2	4					
	4.3	Discussion of results	4					
	4.4	Conclusion	4					
5	Conclusion 5							
	5.1	Conclusion	5					
	5.2	Limits of this study	5					
	5.3		5					
\mathbf{A}	Som	nething	6					
В	Something else							

List of symbols

Acronyms

Glossary

Introduction and background

- 1.1 Preamble
- 1.2 Background on deep level mining
- 1.2.1 Mining profitability
- 1.2.2 Mining systems and energy usage
- 1.2.3 Need to reduce inefficiencies and improve service delivery
- 1.3 Mining compressed air systems
- 1.3.1 Characteristic inefficiencies
- 1.3.2 Inefficiency identification methods
- 1.3.3 Instrumentation and measurements
- 1.4 Use of simulation in industry
- 1.5 Problem statement
- 1.6 Dissertation overview

Literature study

- 2.1 Preamble
- 2.2 Inefficiency identification methods
- 2.3 Review of operational improvements implemented in compressed air systems
- 2.4 Use of simulation to identify improvements in mining systems
- 2.5 Conclusion

Developing a simulation methodology

3	-	D 1	1
`≺		Proamr	NΙΩ
J	• 1	l Preamb	\mathbf{r}

- 3.2 Investigation
- 3.2.1 Layouts, Data from SCADA Instrumentation, etc.
- 3.2.2 Manual measurements, audits and approximations
- 3.2.3 Mining schedule philosophies (drilling, blasting shifts, etc.)
- 3.3 Model development and verification
- 3.3.1 Compressed air component models
- 3.3.2 Simulation inputs
- 3.3.3 verification of model
- 3.4 Implementation of method
- 3.5 Analyses of data
- 3.6 Quantifying operational improvements
- 3.7 Conclusion

Validation of Results

- 4.0.1 Preamble
- 4.1 Case study: Mine A (Kusasalethu)
- 4.1.1 Background
- 4.1.2 Scenario 1. Refuge bay simulation
- 4.1.3 Scenario 2. Closing off levels/stopes
- 4.1.4 Scenario 3. periodic simulation
- 4.2 Case study: Mine B (Tshepong)
- 4.2.1 Background
- 4.2.2 Scenario 1.
- 4.2.3 Scenario 2.
- 4.3 Discussion of results
- 4.4 Conclusion

Conclusion

- 5.1 Conclusion
- 5.2 Limits of this study
- 5.3 Recommendations for future studies

Appendix A
Something

Appendix B Something else

Bibliography

[1] Test. This is a test. The test journal, 2017.