



FACULTY OF ENGINEERING

DEPARTMENT OF MINING ENGINEERING

FINAL YEAR PROJECT REPORT

**DEVELOPING A MODEL FOR NUMERICAL SIMULATION
OF CRACK PROPAGATION IN GYPSUM**

A CASE OF UGANDA MINES

By

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This Final Year Project Report is submitted to the Department of Mining Engineering in partial fulfillment of the requirement for the award of the degree of Bachelor of Science in Mining Engineering of Busitema University

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ABSTRACT

Comprehending failure modes and crack propagation in rock is essential for designing safe and cost-effective structures. Researchers have established theoretical criteria for rock failure by studying crack growth through experimental observations.

This study investigates the crack propagation behavior in rock masses using a combination of numerical simulation and experimental testing. The numerical simulation was performed using Abaqus, employing a cohesive zone and XFEM models to predict crack growth and propagation. The experimental validation was conducted through uniaxial compression testing on rock specimens with pre-existing cracks.

The results show good agreement between the numerical simulation and experimental outcomes, confirming the accuracy of the cohesive zone model in predicting crack propagation. The study highlights the importance of considering the cohesive zone in rock mechanics. It demonstrates the effectiveness of combining numerical simulation and experimental testing for understanding crack behavior in rock masses. The findings have implications for optimizing mining operations, rock stability, and geotechnical engineering applications.

DECLARATION

This research project is my original work except where due acknowledgment has been made. I declare that this work has never been submitted to this university or any other institution for partial fulfillment of any award

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I take this opportunity to thank the almighty God for granting me life, good health, and the ability to research and gather information that is integrated into this report

I am deeply indebted to my dear supervisors, Dr. Joseph Ddumba Lwanyaga and Mr. Kidega Richard for the time, support, guidance, knowledge, and advice provided to me during the preparation of this proposal. May the almighty reward you accordingly

I will never forget my parents and siblings' material and spiritual contributions that allowed me to get here. I am appreciative of them for never losing hope in me.

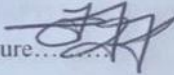
DEDICATION

I dedicate this work to everyone who has helped me in my academic endeavors.

APPROVAL

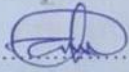
I MASEREKA RONALD M, submit this report of my final year project to the faculty of engineering in the mining engineering department for examination with my supervisor's approval.

Dr. Joseph Ddumba Lwanyaga

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Date.....2024/09/17

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Date.....13/09/2024

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ABBREVIATIONS

UCS- Uniaxial Compressive Strength,

UTS- Uniaxial Tensile Strength

LEFM- Linear Elastic Fracture Method

SIF- Stress Intensity Factor

CZM- Cohesive Zone Model

XFEM- Extended Finite Element Methods

BC- Boundary Conditions

Coh- Cohesive

UTM- Uniaxial Testing Machine