Preface

This book is intended as a reference book for advanced graduate students and research engineers in rock mechanics related to mining engineering. The cemented tailings backfill (CTB) technique is widely used in deep underground mining, since this technique is effective to support surrounding rock, control rockburst, reduce ground subsistence, and reduce surface disposal of tailings. Plenty of investigations have been attempted to experimentally or numerically evaluate the strength of CTB with different components (e.g., mixture of cement, tailings, fly ash, blast furnace slag, etc.) to ensure the geological stability when extracting adjacent stopes. After extracting ore from stopes, CTB is filled in the gob, stress redistribution occurs in the backfill stope and surrounding rocks. Due to the elasticity mismatch of these two kinds of material, differential deformation occurs and they both resist the overburden pressure and deformation. As a result, the interactions between the surrounding rock and tailing backfill material have significant role in maintaining the long-term stability of mine stopes. Apart from the investigations on the static mechanical behaviors of rock-backfill composited backfill (RBCS) material, the RBCS in the stope are also exposed to disturbed stress (e.g., blast vibration, excavation, earthquake, etc.), and the disturbed stress is usually equivalent to cyclic or fatigue loads. As a result, investigations on rock-backfill interactions subjected to the disturbed stress are critical and significant to maintain the long-term stability of mine stopes.

The book is focusing on the effect of complicated stress disturbance conditions for rock-backfill composited material. Fatigue loading and also the alternative fatigue and creep loading are applied to rock-backfill specimens. The first part, Chapters One, Chapters Two, concerns the macro-meso failure partner of cement paste backfill specimen and cemented waste rock backfill specimen under the static loading paths, in-situ x-ray CT technique was also used to reveal the mesoscopic failure mechanism. The second part, Chapters Three, Chapters Four, concerns the mechanical behaviors of RBCS material subjected to fatigue loading conditions. The influence of cement-tailing ratio and the disturbed frequency on the deformation, lifetime, energy evolution and macro-meso failure morphology are deeply investigated. The third part, Chapter Five, concerns the macro-meso instability of RBCS under fatigue-creep interaction loading. A new damage variable is defined using irreversible strain and dissipation energy and an inverted “S” shaped damage evolution model was proposed to describe RBCS damage propagation in the entire process. It is suggested the soft material of CTB absorbs the released elastic energy owing to the fracture of the surrounding

rock, the energy-absorbing characteristics is influenced by the cement-tailing ratio and loading paths. Effort has been made to include a list of comprehensive literature citations in each chapter. However, it is impractical to list all available literature. I apologize sincerely for any omissions.

As mentioned at the beginning, the book is intended as a reference book and not as a text. Thus, the description of phenomena and derivation of equations may not be in depth or in detail as the reader may wish. However, if the reader obtains a clear picture and understanding of the fatigue deterioration of rock-backfill composite material, I would consider the book a success. It is my sincere hope that this book may inspire further research and development into this fascinating subject.

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