Blasting is the controlled use of explosives to excavate or remove rock mass or any harder material. Blasting is the most common and economic technique for rock excavation from the earliest days of invention of explosives to these days of modernisation in mining, civil construction and infrastructural projects. Although there have been significant developments in blasting engineering, application of this technology for rock excavations is associated with a number of safety and stability problems in both opencast and underground workings as blasting can induce damage. The problem of rock mass damage is very acute in underground excavations like mine roadways, drifts, tunnels and caverns in mining and civil engineering projects. Structural damage due to blast induced vibrations and human annoyance due to airblast are the common problems due to surface blasting activities.

Blasting is inherently a destructive activity, though it is meant for constructive operations. Blasting operations results irreversible effects from the point of structural damage and deterioration. Rock excavation engineering gained momentum with blasting technology after use of black powder in Hungary in 1627. A new chapter for rock blasting is started by Swedish chemist Alfred Nobel in 1866 after the invention of dynamite by mixing kieselguhr with nitroglycerine. The rock blasting engineering took a new dimension in late 1950’s after prilled Ammonium Nitrate Fuel Oil (ANFO) mixture began to replace dynamite. Another important development in rock blasting technology was started in 1969, after Emulsion explosives were introduced. Use of electronic delay detonators (EDD’s) in late-1980’s is another remarkable development in the explosives and blasting technology.

Blasting process is a dynamic operation which is completed in few milliseconds. Blasting involves detonation of explosive, fracture initiation and extension, rock throw and fragmentation, generation of vibration, airblast, noise, heat and rock projectiles (flyrock). Blasting is such a complex process that some of the operations like explosive energy interaction and fracturing are yet to be understood completely. Apart from physical modeling and experimentation to understand blast mechanics, numerical modeling has been emerged as an important area to understand some of the complex mechanics of blasting. Rock excavation engineering is a multi disciplinary field involving aspects of Explosive technology, Blasting engineering, Geology, Geotechnical engineering, seismology, structural engineering, risk analysis and other allied fields. Among them blasting engineering is more challenging as many inherent unknowns associated with it. Rock blasting technology requires understanding of the rock properties, explosive properties and blast design parameters. It also requires proper understanding of the pre-blast conditions and post-blast effects. Blasting produces seismic waves similar
to those produced by earthquakes, but with relatively high frequency and low amplitude and the degree of structural damage depends on the total energy of explosion, distance from the source, and the characteristics of the medium. Therefore understanding of the mechanics and new developments in the area of blasting certainly helps to the field of earth quake engineering. Similar to earth quake induced destruction, blast induced vibrations might create safety problems to surface structures and weakens the rock mass in the underground excavations, potentially leading to stability problems.

In a properly designed blast round the explosive energy used for rock excavation is upto 20% only. The remaining energy will be manifested in side effects like vibration, airblast and noise. These ill-effects have become the haunting problems of safety and stability in both surface and underground structures. Therefore, it is intended to deal with the ill-effects of blasting for fullest exploitation of this method of rock excavation. The objective of this special issue is to focus of the understanding of the mechanics of the blasting, rock fracturing and the dynamic response of structures including, instability, deterioration and damage. Rock mass damage in underground openings occurs mainly due to blast induced forces, stress redistribution and weathering. As underground excavations are carried out, the in-situ stresses redistribute around the boundary of the openings, leading to high stresses on the backs and corners of the excavations and the blasting activity creates initiation and extension of fractures in the surrounding rock mass. In view of the large amount of rock excavations for mining and civil construction projects it is imperative to develop blast induced damage assessment and control measures for safety and stability of both surface and subsurface structures. In this issue, it is aimed to disseminate the latest developments emerged globally in the area of prediction and assessment of blast induced vibrations and damage as well as controlling measures.

There are seven invited papers in this special issue on ‘Dynamics and blasting’ from the eminent academics and active researchers. The technical papers covered the topics of Blast-induced vibrations in longhole open stoping; Numerical prediction of rock fracturing; Blast and impact assessment by dynamic tensile test; Numerical simulation of engineering blasting; Blast damage prediction; A new blast vibration prediction model incorporating variations of burden distance and Static and dynamic elastic modulus of jointed rock mass based on joint factor. Besides the Editor-in-Chief and Guest editor, the papers were thoroughly reviewed by Dr. G.R. Adhikari of NIRM, Dr. M.R. Saharan of CIMFR, Dr. A.K. Raina of CIMFR, Dr. V.M.S. R. Murthy of ISM, Dr. A.K. Jha of CMPDIL, Prof. Agne Rustan, Lulea University of Technology, Sweden and Prof. J.A. Sanchidrián, University of Polytechnic, Spain. The efforts of all the reviewers and the positive response from all the contributing authors are gratefully acknowledged.
More Ramulu is working as Senior Scientist in Central Institute of Mining & Fuel Research (Erstwhile CMRI), Regional Centre, Nagpur, India under the aegis of Council of Scientific and Industrial Research, New Delhi, India. He has got 14 years of research experience in Rock Mechanics and Blasting Engineering. His main research area of specialization is Blast optimization and Controlled blasting. He completed his Bachelors in Mining Engineering from Osmania University in the year 1995 with three University Gold medals and joined as Research Fellow in CMRI in the same year. He was also awarded MGMI gold medal for excellent academic track record. He completed M.Tech in Blasting Engineering from Visveswaraya National Institute of Technology with A-grade distinction. He was awarded PhD in Blasting & Geotechnical Engineering from Indian Institute of Science (IISc), Bangalore under the guidance of Prof. T.G. Sitharam and Dr. A.K. Chakraborty. Dr. Ramulu published 25 technical papers in various Journals and more than 25 papers in Conferences. He also filed 5 patents on the Blasting methods and devices, which include both Indian and US patents. Dr. Ramulu received a National award from Mining Engineers Association of India (MEAI) for his contributions towards development of a new blasting technique in underground mines.