

Modern numerical methods and their applications in mechanical engineering

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Numerical simulation is a powerful tool to solve scientific and engineering problems. It plays an important role in many aspects of fundamental research and engineering applications, for example, mechanism of turbulent flow with/without viscoelastic additives, optimization of processes, prediction of oil/gas production, and online control of manufacturing. The soul of numerical simulation is numerical method, which is driven by the above demands and in return pushes science and technology by the successful applications of advanced numerical methods. With the development of mathematical theory and computer hardware, various numerical methods are proposed. The new numerical methods or their new applications lead to important progress in the related fields. For example, parallel computing largely promotes the precision of direct numerical simulations of turbulent flow to capture undiscovered flow structures. Proper orthogonal decomposition method greatly reduces the simulation time of oil pipelining transportation. The development of commercial computational fluid dynamics (CFD) software also depends on the advancement of numerical methods. Thus, numerical methods become more and more important and their modern developments are worth exploring.

To reflect the frontier researches in numerical methods with applications, this special collection was established with the editorial team members from China, Italy, USA, and Norway. The guest editors are from both universities and industrial companies. The high quality and diversity of the editorial team members ensure the special issue collected 22 high-quality articles, from China, USA, Czech Republic, Turkey, Saudi Arabia, Korea, Vietnam, and India, providing a state-of-the-art insight to the specific topics including solid mechanics, fluid mechanics, optimization, and system stability.

In the article "Mechanical and failure characteristics of rock-like material with multiple crossed joint sets under uniaxial compression," Bonded-Particle Model

(BPM) using PFC3D is used to explore the effect of joint sets number and joint spacing on the mechanical behavior of a jointed rock mass under uniaxial compression. Stress concentration is found to be the reason for relatively lower strength of blocks with crossed joint sets compared to the block with the same weakest joint set. The results are helpful to reveal the mechanism of damage and fracture of jointed rocks under uniaxial compression.

In the article "Discrete element method simulations of load behavior with mono-sized iron ore particles in a ball mill," the sphere-clump method is employed to determine the geometrical shape of the mono-sized iron ore particles. Through discrete element method simulations, the impact of mill speed and lifter on the load behavior of iron ore particles in a ball mill not only potentially facilitates the improvement in high-performance liners but also optimizes the mill speed in the pre-design stage.

In the article "Lumped parameter model and numerical model of vapor bubble-driven valve-less micropump," a lumped parameter model for a vapor bubble-driven valve-less micropump is established and validated by the numerical simulation using ANSYS Fluent, in terms of bubble dynamics and flow performance. The results indicate that the lumped parameter model can be a convenient tool to guide the design of the micropumps.

In the article "On effect of viscoelastic characteristics of polymers on performance of micropump," a numerical modeling of polydimethylsiloxane (PDMS) micropump behavior using the fluid-structure interaction (FSI) along with viscoelastic material is demonstrated to capture FSIs accurately. The simulations can be extended for analysis of PDMS-based check-valve micropumps and other lab-on-a-chip devices under dynamic loading.

In the article "Applications of the discontinuous Galerkin method to propagating acoustic wave



Applications Of Numerical Methods In Mechanical Engineering

G Psacharopoulos



Applications Of Numerical Methods In Mechanical Engineering:

Reviewing **Applications Of Numerical Methods In Mechanical Engineering**: Unlocking the Spellbinding Force of Linguistics

In a fast-paced world fueled by information and interconnectivity, the spellbinding force of linguistics has acquired newfound prominence. Its capacity to evoke emotions, stimulate contemplation, and stimulate metamorphosis is actually astonishing. Within the pages of "**Applications Of Numerical Methods In Mechanical Engineering**," an enthralling opus penned by a highly acclaimed wordsmith, readers embark on an immersive expedition to unravel the intricate significance of language and its indelible imprint on our lives. Throughout this assessment, we shall delve into the book's central motifs, appraise its distinctive narrative style, and gauge its overarching influence on the minds of its readers.

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