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Editorial

Special Issue "Computational Methods for Fracture"

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The prediction of fracture and material failure is of major importance for the safety and reliability of engineering structures and the efficient design of novel materials. Experimental testing is often cumbersome, expensive and, in certain cases, unfeasible, for instance in civil engineering when it is not possible to test the structures in the laboratory. Therefore, computational modeling of fracture and failure of engineering systems and materials has been the focus of research for many years, and there has been tremendous advancements in the past two decades with methods such as the Extended Finite Element Method (XFEM) developed in 1999, peridynamics (2000), the cracking particles method (2004) and phase field models (2009). There has also been a great deal of effort made in developing multiscale methods for the design of new materials, such as the Extended Bridging Domain Method or the MAD method. The main focus of this book is computational methods for fracture. However, articles concerning issues related to validation, uncertainty quantification, large-scale engineering applications and constitutive modeling are also addressed.

This book offers a collection of 17 scientific papers about computational modeling of fracture [1–17]. Some manuscripts propose new computational methods or the improvement of existing cutting-edge methods for fracture. Other manuscripts apply state-of-the-art methods to challenging problems in engineering and materials science.

These contributions can be classified into two categories:

1. Methods which treat the crack as strong discontinuity, such as peridynamics, scaled boundary elements or specific versions of the smoothed finite element methods applied to fracture;
2. Continuous approaches to fracture based on, for instance, phase field models or continuum damage mechanics. On the other hand, this book also offers a wide application range where state-of-the-art techniques are employed to solve challenging engineering problems including fractures in rock, glass, and concrete. Larger systems are also studied, including subway stations due to fire, arch dams and concrete decks.

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