About the Book
The study of fracture mechanics of concrete has developed in recent years to the point where it can be used for assessing the durability of concrete structures and for the development of new concrete materials. The last decade has seen a gradual shift of interest toward fracture studies at increasingly smaller sizes and scales. Concrete Fracture: A Multiscale Approach explores fracture properties of cement and concrete based on their actual material structure. Concrete is a complex hierarchical material, containing material structural elements spanning scales from the nano- to micro- and meso-level. Therefore, multi-scale approaches are essential for a better understanding of mechanical properties and fracture in particular. This volume includes various examples of fracture analyses at the micro- and meso-level. The book presents models accompanied by reliable experiments and explains how these experiments are performed. It also provides numerous examples of test methods and requirements for evaluating quasi-brittle materials. More importantly, it proposes a new modeling approach based on multiscale interaction potential and examines the related experimental challenges facing research engineers and building professionals. The book's comprehensive coverage is poised to encourage new initiatives for overcoming the difficulties encountered when performing fracture experiments on cement at the micro-size/scale and smaller. The author demonstrates how the obtained results can fit into the larger picture of the material science of concrete—particularly the design of new high-performance concrete materials which can be put to good use in the development of efficient and durable structures.

Salient Features
Provides in-depth understanding of the fracture of cement and concrete
Presents a state-of-the-art overview of fracture models for concrete
Includes clear descriptions of experimental techniques for stable fracture experiments on cement and concrete
Debates the advantages and disadvantages of current approaches to model fracture
Offers an alternative approach to size/scale effects, based on crack statistics
Suggests an agenda for future micro-fracture experimentation
Proposes a new modeling approach based on multiscale interaction potential

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About the Author

Jan G.M. van Mier received his engineering and Ph.D. degrees from Eindhoven University of Technology. After a postdoctorate year at the University of Colorado in Boulder, he moved to Delft University of Technology. As an associate professor at the Stevin Laboratory, in close cooperation with several Ph.D. students, he developed the Delft lattice model and conducted numerous experiments elucidating the fracture of concrete under a variety of conditions. In 1999, he was appointed "Antonie van Leeuwenhoek" professor at TU Delft, based on excellence in research, and developed and built the new microlab to immerse in fracture studies at smaller size/scales than before. In 2002, he moved to ETH Zurich as full professor and director of the Institute for Building Materials. In 2010, he became president of the International Association for Fracture Mechanics of Concrete and Concrete Structures (IA-FraMCoS).