

Foreword

Fracture mechanics as a discipline of mechanics goes back to the early years of the 20th century. It started with the description and explanation of the cracking behavior and failure of glass which could not be explained by means of the strength of materials approach. The material to which the new theory was applied had to be elastic and brittle. After glass, the failure of brittle types of metals was investigated. Later, linear elastic fracture mechanics was extended to elastic–plastic material behavior with well-established theories.

Although concrete exhibited brittleness in conventional force-controlled tensile tests, it was only in the early 1960s that fracture mechanics principles penetrated slowly into the field of concrete. First attempts were made to apply linear elastic fracture mechanics to concrete, but there was no great success. However, the idea to apply fracture mechanics to concrete and concrete structures was very important. Many researchers started to think of concrete and fracture mechanics. At the same time, the testing facilities developed enormously. It became possible to perform displacement-controlled tensile tests on concrete. One realized that concrete is not perfectly brittle but strain softening, i.e., failure in tension, occurred only after a considerable nonelastic displacement in the post-peak region. The idea of cohesive stresses in a concrete crack emerged.

After recognizing the real behavior of concrete, nonlinear fracture mechanics theories were developed. The present book presents these theories in detail. The book is a comprehensive treatment of the state of knowledge and adds some new findings to the field. The authors succeeded to write the book in a way that sometimes complicated theories can be followed with ease. I congratulate the authors to this achievement and wish that not only many teachers will use the book in their classes but also code makers will use it as a compendium of the principles of fracture mechanics of concrete in order to introduce these principles finally into the design standards.

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