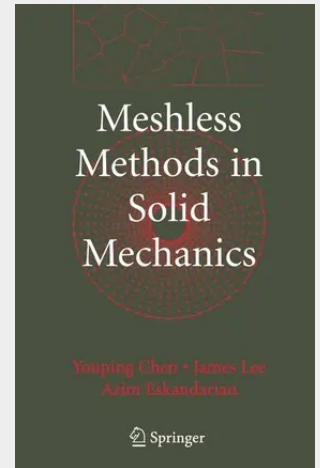


Meshless Methods in Solid Mechanics

Finite element method has been the dominant technique in computational mechanics in the past decades, but this method is not well suited to problems having severe mesh distortion. This book covers the fundamentals of continuum mechanics, the integral formulation methods of continuum problems, the basic concepts of finite element methods, and the methodologies, formulations, procedures, and applications of various meshless methods. It also provides general and detailed procedures of meshless analysis on elastostatics, elastodynamics, non-local continuum mechanics and plasticity with a large number of numerical examples. Some basic and important mathematical methods are included in the Appendixes. For readers who want to gain knowledge through hands-on experience, the meshless programs for elastostatics and elastodynamics are also introduced in the book and included in the disc.

Finite element method has been the dominant technique in computational mechanics in the past decades, and it has made significant contributions to the developments in engineering and science. Nevertheless, FEM is not well suited to problems having severe mesh distortion owing to extremely large deformations of materials, encountering moving discontinuities such as crack propagation along arbitrary and complex paths, involving considerable meshings and remeshings in structural optimization problems, or having multidomain of influence in multiphenomena physical problems. It is impossible to completely overcome those mesh-related difficulties by a mesh-based method. The highly structured nature of finite element approximations imposes severe penalties in seeking the solutions of those problems. Distinguishing with finite element, finite difference, and finite volume methods, meshless method discretizes the continuum body only with a set of nodal points and the approximation is constructed entirely in terms of nodes. There is no need of mesh or elements in this method. It does not possess the mesh-related difficulties and provides an approach with more flexibility in the applications in engineering and science. The meshless method started to capture the interest of a broader community of researchers only several years ago, and now it becomes a growing and evolving field. It is showing that this is a very rich area to be explored, and has great promise for many very challenging computational problems. On the one hand, great advances of meshless methods have been achieved. On the other hand, there are many aspects of meshless methods that could benefit from improvements. A broader community of researchers can bring diverse skills and background to bear on the task of improving this method.



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