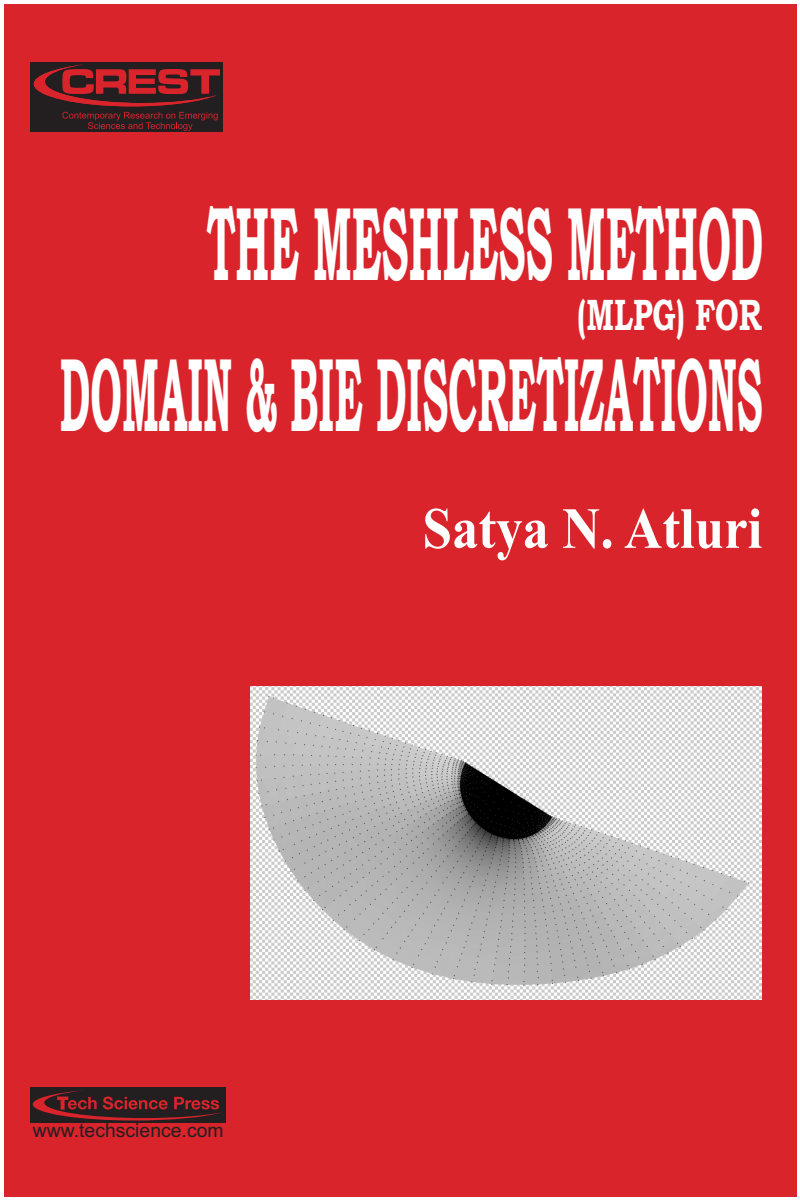

This monograph is a sequel to: " The Meshless Local Petrov-Galerkin (MLPG) Method", by S. N. Atluri, and S. Shen, published in 2002. In the intervening two years, much has been accomplished by a number of researchers world-wide, in the further development & application of the meshless method (MLPG) to problems in three-dimensional solid mechanics, beams, plates and shells; and in the seamless modeling of multi-scale phenomena in nano and micro engineering. In addition to providing a summary of these accomplishments, an important feature of the current comprehensive monograph is the presentation of meshless methods to discretize the boundary-integral-equations in mechanics. Thus, the present monograph presents, for the first time, a detailed summary of research on the next generation of computational methods in engineering & the sciences, that go beyond the mesh-based finite-element & boundary-element methods that were so successfully developed in the final two decades of the last century.

Contents: Chapter I Global Weak Forms, Weighted Residuals, Finite Elements, Boundary Elements, & Local Weak Forms: Global weak forms and the weighted residual method (WRM); The Galerkin finite element method; The boundary element method; Local weak-forms over overlapping sub-domains. **Chapter II Meshless Interpolations of Trial & Test Functions:** Interpolations with a local-support; The moving least-squares Approximation scheme; Shepard functions; The partition of unity (PU) methods; Reproducing kernel particle interpolation (RKPM); Radial basis functions (RBF) with compact support; Smoothed particle hydrodynamics; Interpolation errors in meshless interpolations. **Chapter III MLPG Method for Domain Discretization:** Numerical implementation of the MLPG method; The imposition of essential boundary conditions in the MLPG approach; Numerical integration of the various local weak-forms; Computational costs; The MLPG approach to nonlinear problems; **Chapter IV The MLPG Method for the Discretization of Boundary Integral Equations (BIE):** Simple formulations of weakly-singular traction & displacement BIE; MLPG approaches for solving the weakly-singular BIEs; MLPG/BIE for acoustic radiation & scattering problems. **Chapter V The MLPG in Solid Mechanics: 3-D Singular Problems and Material Discontinuities; Locking-Free Beam, Plate, & Shell Formulations;** Formulation for the 2D elasto-static problem; Discretization and numerical implementation; Application of the MLPG method to problems with singularities, and material discontinuities, in 3-D elasticity;The MLPG6 method for solving 3D Problems in elasto-statics; The MLPG approach for 3-Dimensional elasto-dynamics; The MLPG method for beams, plates and shells through a 3-D elasticity formulation, and the locking phenomenon; Analysis of beams using GMLS; MLPG1 and MLPG5 for thin beam problems (4th order formulation); Analysis of shear flexible beams based on locking-free formulation: seamless analysis from thick to thin beams; MLPG method for solving the bending problem of a thin plate (4th order formulation). **Chapter VI Application of the MLPG in Fluid Mechanics:** Upwinding schemes for MLPG; Convection-diffusion problems; Burgers' equations; Incompressible Navier-Stokes equations. **Chapter VII Application of the MLPG in Strain Gradient Theories of Material Behavior, Nanotechnology, and Multi-Scale Modeling:** Analysis of materials with strain-gradient effects; Numerical simulations in nano- and micro-mechanics of materials; Multiscale simulation based on the MLPG method; MLPG/BIE method for multiscale simulation. *About 700 pages.*

A very comprehensive list of more than 300 references to the literature is included.

About the author

Satya N. Atluri, is the Henry Samueli/von Karman Chair in Aerospace Engineering at the University of California, Irvine. He is a Member of the U.S. National Academy of Engineering, a Foreign Fellow of the Indian National Academy of Engineering, a Fellow of the Third World Academy of Sciences, a Member of the European Academy of Sciences,

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