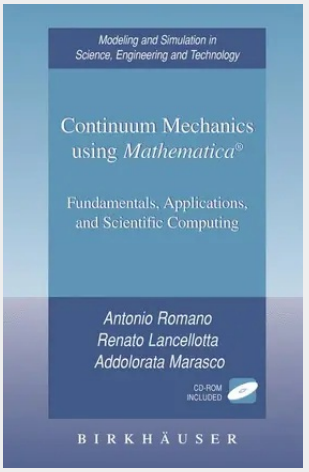
Romano / Lancellotta / Marasco

Continuum Mechanics using Mathematica®

Fundamentals, Applications and Scientific Computing



This book examines mathematical tools, principles, and fundamental applications of continuum mechanics, providing a solid basis for a deeper study of more challenging problems in elasticity, fluid mechanics, plasticity, piezoelectricity, ferroelectricity, magneto-fluid mechanics, and state changes. The work is suitable for advanced undergraduates, graduate students, and researchers in applied mathematics, mathematical physics, and engineering.

The motion of any body depends both on its characteristics and the forces acting on it. Although taking into account all possible properties makes the equations too complex to solve, sometimes it is possible to consider only the properties that have the greatest in? uence on the motion. Models of ideals bodies, which contain only the most relevant properties, can be studied using the tools of mathematical physics. Adding more properties into a model makes it more realistic, but it also makes the motion problem harder to solve. In order to highlight the above statements, let us ?rst suppose that a systemS ofN unconstrainedbodiesC ,i=1,. ,N,issu?cientlydescribed i by the model of N material points whenever the bodies have negligible dimensions with respect to the dimensions of the region containing the trajectories. ThismeansthatallthephysicalpropertiesofC thatin?uence i the motion are expressed by a positive number, themass m, whereas the i position of C with respect to a frame I is given by the position vector i r (t) versus time. To determine the functionsr (t), one has to integrate the i i following system of Newtonian equations: m¨ r =F ?f (r ,. ,r ,r ? ,. ,r ? ,t), i i i i 1 N 1 N i=1,.

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