FINITE ELEMENT METHODS

Finite element methods (FEM) and topics related to finite element applications are presented in Part Three. We have seen in Chapter 1 that the finite element methods based on the standard Galerkin integral lead to results identical to those of the finite difference methods (FDM) for the examples of simple linear problems. In dealing with nonlinear or convection-dominated flow problems in fluid dynamics, however, the standard Galerkin methods are no longer adequate. Various special strategies must be designed to assure stability and convergence, as we noted also in FDM. Dissipation and dispersion errors can be minimized with a high level of accuracy achieved in much the same way as in FDM. In this vein, the reader will see that finite element methods are analogous to finite difference methods in dealing with all aspects of the physics of fluids. Developments of both approaches in close alliance are shown to be complementary to each other. It is with this expectation that our journey begins.