ABSTRACT

The rapid developments in computer technology have provided opportunities for sophisticated nonlinear analysis of concrete structures incorporating complex constitutive modelling and applying the finite element method, efficient solution methods and simulation techniques. In this study, the nonlinear analysis of plane and axisymmetric structures is developed on the basis of a hypoelastic constitutive model for concrete involving a new spiral ultimate strength surface. The computational paradigm "Artificial Neural Network" is employed to derive the ultimate strength surface. For plate and shell structures, the strain hardening plasticity model is used. A compatible model for reinforcement is described representing it as a smeared layer for any arbitrary orientation of reinforcement. A user friendly software "FENLACS" (Finite Element NonLinear Analysis of Concrete Structures) supported by efficient preprocessor and postprocessor is developed. The software is extended for the analysis of structures subjected to dynamic and impact loadings using Newmark's method for the solution of dynamic equilibrium equations. The behaviour is studied by eliciting load-deformation response, crack pattern, crack propagation and stress contours using the multiple window system of postprocessor. The variation of deformation,
velocity and acceleration with time are predicted for various types of load-time history curves in the case of structures subjected to impact loadings. The behaviour of various structures predicted using "FENLACS" is compared with the results of benchmark experiments conducted by many investigators. A wide variety of structures is analysed using "FENLACS" and the capability of the software is illustrated.