Material Modeling Of Reactive Powder Concrete Using Ansys – A Review.

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Abstract

ANSYS has many finite element analysis capabilities, ranging from a simple, linear, static analysis to a complex, nonlinear, transient dynamic analysis, which is used by engineers worldwide in virtually all fields of engineering. In order to investigate the possibilities of current FE programs for implementation of steel fibre concrete this study was conducted. The aim of this study was to show the use of steel fibre concrete with FE calculations, to point out the possibilities and restrictions and to give recommendations for practical usage. Because of the complexities associated with the development of rational analytical procedures, present day methods continue in many respect to be based on the empirical approaches using result from a large amount of experimental data. The finite element (FE) method offers a powerful and generic tool for studying the behavior of structures.
Key words: RPC, non linear analysis, ANSYS, shear

1. Introduction

In the emerging world of technologies, research on the concrete of better and better physical, mechanical and durability, have given us much denser and ductile material called "Reactive Powder Concrete" (RPC). RPC is a special concrete having ultra high strength and ductility. It is a cementitious composite where the micro structure is optimized by precise gradation of all particles in the mix to yield maximum density. The design method for steel fibre reinforced concrete (SFRC) recommended by RILEM TC 162-TDF is based on the traditional section-analysis method used for normal reinforced concrete (RC) and, hence, offers a convenient means for designing SFRC elements. The difference between the two design methods is that the stress-strain (σ-ε) model used for the design of SFRC does not ignore tension and takes into account the tension stiffening due to the steel fibers.

The FE analyses of the RPC specimens tested in this investigation was carried out in using software ANSYS and procedure to analyze structure using ANSYS.

2. Why Ansys?

One of the main tasks for material engineers and structural designers who deal with quasibrittleBuilding materials is the determination of fracture parameters. Usually these parameters are calculated from experimentally obtained data (load-deflection diagram, *l-d* diagram) using Fracture-mechanics principles with the presumption that a stress concentrator formed in theTesting specimen is a crack. ANSYS provides all the power of nonlinear structural capabilities as well as linear capabilities to deliver the highest quality, most-reliable structural simulation results available. ANSYS post processing is used to review the results once the solution has been calculated. There are two post processors general postprocessor and time history postprocessor. The general postprocessor is used to obtain the contour displays, deformed shapes, and tabular listings to review and interpret the results of the analysis. the graph plot of results data versus time and tabular listings can be obtained from the time history postprocessor.

3. APPLICATION OF ANSYS IN STRUCTURAL ENGINEERING

Static analysis-A static analysis calculates the effects of steady loading conditions on a structure, while ignoring inertia and damping effects, such as those caused by time-varying loads. A static analysis can, however, include *steady* inertia loads (such as gravity and rotational velocity), and time varying loads that can be approximated as static equivalent loads (such as the static equivalent wind and seismic loads commonly defined in many building codes). Modal analysis-Used to calculate the natural frequencies and mode shapes of a structure. Different mode extraction methods are available.Transient dynamic analysis- Used to determine the response of a structure to arbitrarily time-varying loads. All nonlinearities mentioned under Static Analysis above are allowed.

Spectrum analysis- An extension of the modal analysis, used to calculate stresses and strains due to a response spectrum or a PSD input (random vibrations).Buckling analysis-Used to calculate the buckling loads and determine the buckling mode shape. Both linear (eigenvalue) buckling and nonlinear buckling analyses are possible.

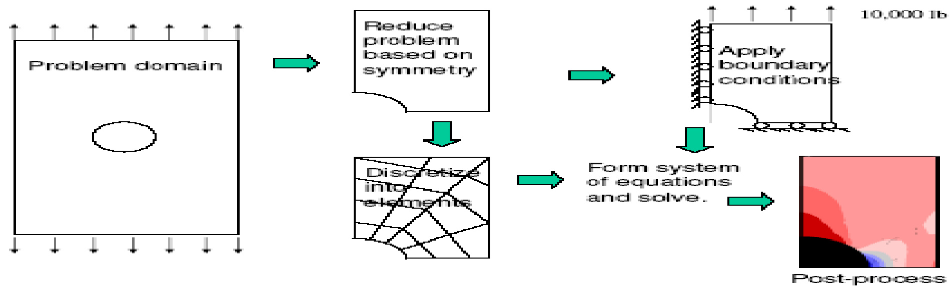

Fig.1.0 Flow diagram for analysis

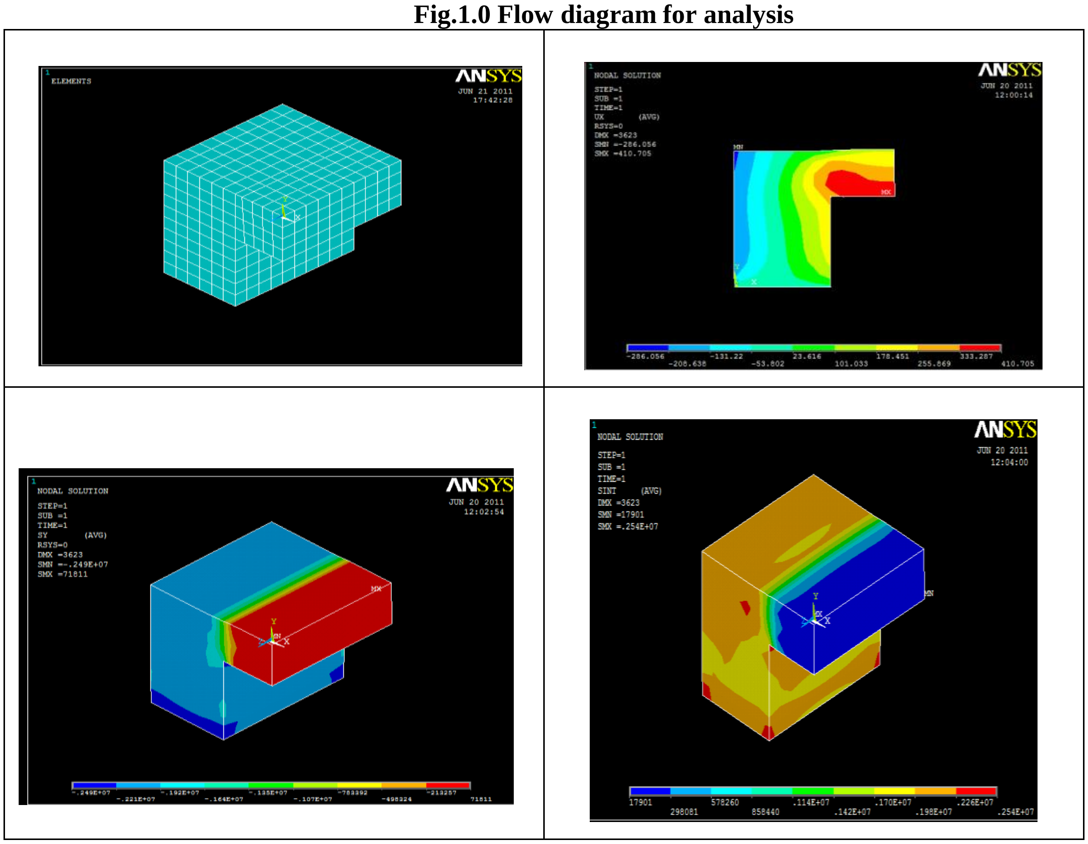

Fig. 2.0 specimen meshing and stress contour

4. Modelling

Modeling is the primary task of any analytical study and the result obtained to a large extent depends on the simplification taken during in this step. Modeling involves creation of geometry of overall structure by including elements of various components representing respective structural behavior including boundary conditions in the considered problem, Material properties of various elements and loads on various elements and its combinations were defined.

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4.0 RESULTS AND DISCUSSION

To the presence of dominant shear stresses, the specimen geometry was studied using finite element analysis, the stress concentration are obtained as shown in **Fig.2.0** indicating the possibility of cracking. The shear stress distribution is shown in **Fig. 2.0** with darker zone indicating higher stresses. It can be seen as that there is a zone of shear stresses at the junction of “L” shape specimen, conforming that shear failure would occur if tensile cracking was to be restrained by fibres. As a result clear shear crack propagation can be observed at the junction of “L” shape specimen.This paper presents a model for determining the stress-strain characteristics of SFRC by using experimental data and FE analysis. This model describes the behavior of SFRC in four phases and gives good results for a range of fibres tested. Optimum thickness of shear plane to be considered is 60 mm which is getting conformed by FE analysis. Initially RPC shows linearly elastic behavior and then dominated by plastic behavior representing the behavior of Elasto-plastic material. The toughening observed in the test is a result of the pull out and dowel action of the fibre during the shear cracking. The pull out resistance tends to close the cracks, while the shear forces tends to open it due to the irregularity of the crack face as illustrated in **Fig.3.0** this produces a confining effect which together with the dowel action of the fibres and friction between the crack faces, can lead to an increase in the shear strength.

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