Title Extraction of Strut-and-Tie Models from Finite Element Analysis Using Shell Elements

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Abstract

Strut-and-tie model (STM) method is a lower bound method based on the theory of plasticity, which can be suitable for the design of concrete members in D region. An approach for finding an appropriate strut-and-tie model (STM) for concrete structure is introduced. In this approach, STM is extracted from the finite element linear-elastic analysis of concrete deep beams and shear walls using shell element mesh. The finite element analysis is performed in FEA computer program that has the meshing capability. The force trajectories in concrete member are obtained and then extracted into struts and ties and graphically displayed thru an implementation of computer program. The algorithms include two main important features: (1) to extract and display an appropriate strut-and-tie model from the output of FEA; and (2) to refine, analyze and design the extracted appropriate strut-and-tie model. Concrete deep beam and shear wall concrete structures were used as examples to demonstrate the capability of the proposed method in finding an appropriate strut-and-tie model of each concrete structure. These examples were taken from the previous experimental studies, practical cases, and other approaches that deals with STM for the purpose of comparison and verification of the results.

Keywords Strut-and-tie model, Finite element analysis, shell elements.