A Comparative Study between FEM and Meshless Methods

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Abstract : Numerical simulation techniques are widely used now in product development and testing instead of expensive, time-consuming and sometimes dangerous laboratory experiments. Numerous numerical methods are available for performing simulation of physical problems of different engineering fields. Grid based methods, like Finite Element Method, are extensively used in performing various kinds of static, dynamic, structural and non-structural analysis during product development phase. Drawbacks of grid based methods in terms of discontinuous secondary field variable, dealing fracture mechanics and large deformation problems led to development of a relatively a new class of numerical simulation techniques in last few years, which are popular as Meshless methods or Meshfree Methods. Meshless Methods are expected to be more adaptive and flexible than Finite Element Method because domain descretization in Meshless Method requires only nodes. Present paper introduces Meshless Methods and differentiates it with Finite Element Method in terms of following aspects: Shape functions used, role of weight function, techniques to impose essential boundary conditions, integration techniques for discrete system equations, convergence rate, accuracy of solution and computational effort. Capabilities, benefits and limitations of Meshless Methods are discussed and concluded at the end of paper.

Keywords : numerical simulation, Grid-based methods, Finite Element Method, Meshless Methods