

INTRODUCTION

As a part of its service, pressure vessels have multiple nozzle openings which causes its strength reduction. Some nozzles in the critical areas of pressure vessels like knuckle regions or sometime even on the shell plays a vital role in strength of a pressure vessel. Considering the severity of the possible failure of nozzle to shell junction, a FEA is performed for structural strength assurance.

Process equipment manufacturer from India & Abroad approached ANALYZER to seek assistance in evaluating the design of their newly developed vessels to multiple loadings using simulation techniques.

FEA WORKFLOW

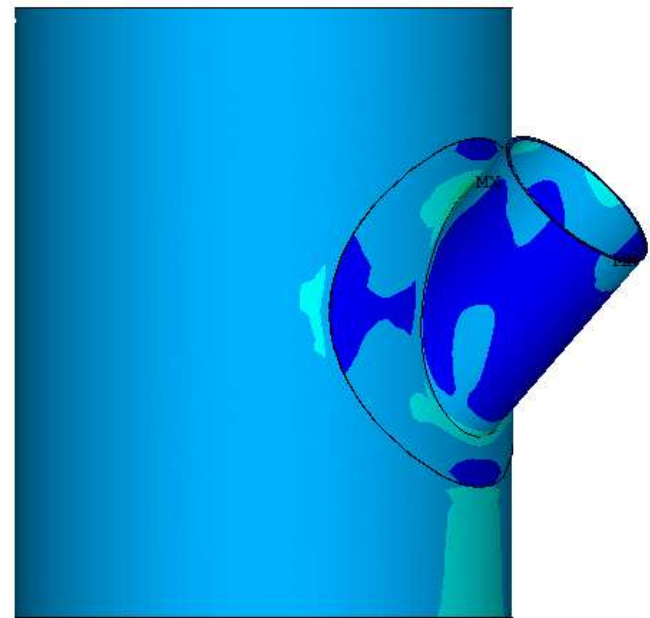
- Determining the various loading conditions affecting strength of desired nozzle to shell junction of pressure vessel.
- Preparing FEA Model for Nozzle to shell junction without losing the stress distribution
- Preparing an easy to understand report for the performed FEA.

CHALLENGES

- Preparing CAD/FEA Model in order to capture complete Stress Distribution near the junction
- Nozzle Load Application in FEA

THE SOLUTION

The Nozzle to Shell junction was analyzed using finite element method to determine the structural strength against the various applicable loading like internal pressure, nozzle loads & combination. In order to assess strength for the structure, guidelines from ASME BPVC (Boilers & Pressure Vessels Code) Section VIII Div. 2 Ed. 2013 was utilized. For evaluating various stresses across nozzle & shell thickness, stress linearization is carried out across nozzle & shell thicknesses. The results showed that the induced stresses were well within the acceptable limits as per guidelines. Hence, the structure's design was predicted to behave safe during operation without premature failure.



BENEFITS

- Better insights on design modifications of a particular nozzle for alternate applications
- Localized failure can be removed at design stage itself avoiding dangers of vessel in-service failure
- Optimized design with reduced material cost
- Reduced manufacturing time