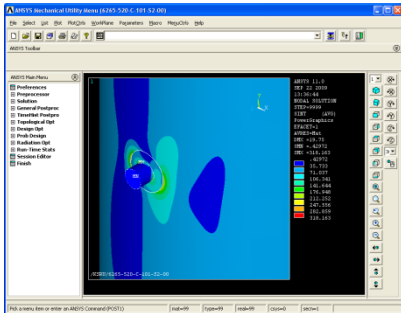


Cutting Edge

Analysis
Finite Element / Fluid Flow



Finite Element Analysis

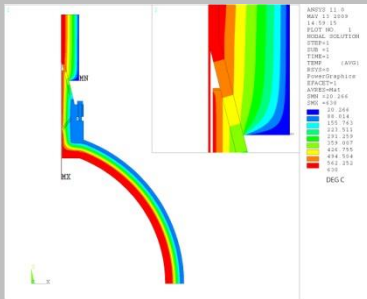


Stress Analysis

- Carry out complex analysis; consultation and investigation of countermeasures.
- Perform structural analysis.
- Evaluate analysis results against client/code requirements.
e.g. Shell-Nozzle junction analysis, baffle tray deformation analysis and more...

Benefit

- Obtain results derived from highly developed technical analysis.
- Obtain a correct and fair evaluation.
- Avoid need to employ specialists, expensive computers and software.
- Minimize the design changes at the shipping stage due to unavoidable circumstances.

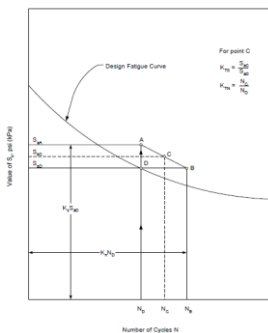


Thermal Analysis

- Thermal analysis to check temperature distribution followed by stress analysis due to temperature gradients.
- Evaluation of results with client/code requirements.
e.g. Reactor nozzle stress analysis and more...

Benefit

- Proper temperature distribution across the sections.
- Exact thermal stress calculation (up to 70% of total stresses in reformers)
- Insulation thickness requirements to avoid hot spots.

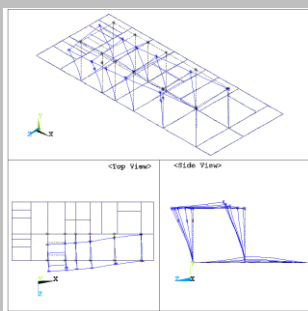


Fatigue Analysis

- Stress analysis followed by fatigue life evaluation for cyclic operations.
- Evaluation of results with client requirements.
e.g. Coke drum support skirt-shell junction fatigue analysis and more...

Benefit

- Predict the fatigue life for cyclic condition.
- High cycle fatigue life estimation is necessary for safe operation of equipment.



Modal and Harmonic Analysis

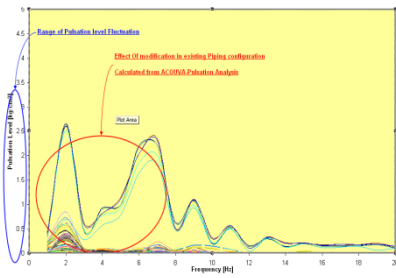
- Natural frequency and mode shape calculation for structures and equipments.
- Evaluation of results with client requirements.
e.g. Compressor base structure analysis and more...

Benefit

- Natural frequency calculation is used to check the vibration possibility and magnitude.

Fluid Flow Analysis

Pulsation and Vibration Analysis

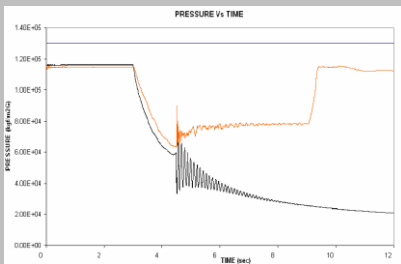


- Control pulsation and vibration levels on a reciprocating compressor piping system according to API-618 standards.
 - Optimize design of piping support system and pulsation suppression devices taking into consideration pulsation and vibration resonance.
- e.g. Reciprocating compressor suction and discharge line

Benefit

- The client can obtain a detailed assessment of vibrating piping system to determine if modification is necessary.
- Problems can be minimized by controlling piping pulsation and vibration at the design stage.

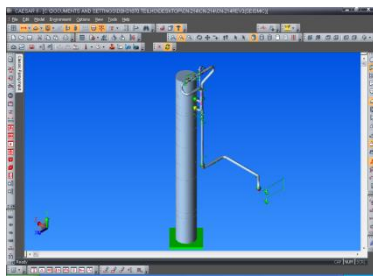
Surge Analysis



- Reliable program used based on the MOC.
 - Study the piping elements covered such as pump station, control valve, relief valve, surge tank, air valve, and reservoir.
 - Optimize valve stroking
 - Compute column separation by using an accurate gas release model.
- e.g. Cross country piping, pump auto-trip and auto-start condition and more...

Benefit

- The client can prevent accidents due to water hammering.
- Design of piping elements and loading data will be optimized with consideration given to pressure surge in the piping system.

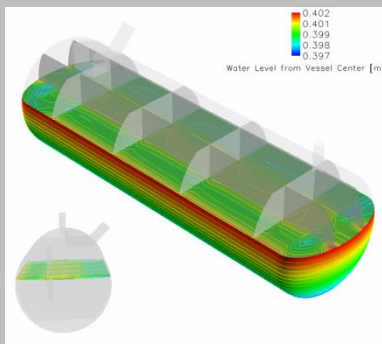


Dynamic Analysis of Piping System

- Response Spectrum analysis
- Harmonic/Modal analysis
- Flow induced vibrations
- Time history analysis
- Two-phase analysis

Benefit

- Providing optimum solution by calculating dynamic forces induced on piping helps in preventing vibrations of piping system.

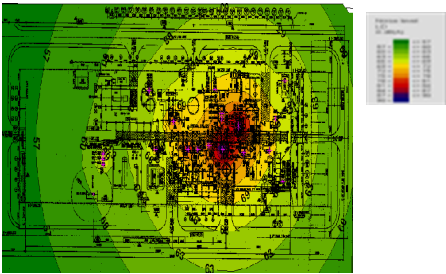


Computational Fluid Dynamics

- Steady / Unsteady Problems
- One, Two and Three Dimensional Problems
- Compressible / Incompressible Flows
- Conjugate Heat Transfer Problems (Conduction, Convection and Radiation)
- Multiphase Flow Problems (gas-liquid, solid-liquid, solid-gas, gas-liquid-solid and phase change)

Benefit

- Propose the best suited models and CFD code for the analysis to realize accuracy and efficiency
- Highly-experienced experts create an analysis report with comprehensive explanation and deep consideration on the computation results and with practical suggestions or recommendations to overcome Customer's facing problems.



Noise Analysis

- Predict composite noise level propagation in the plant and at battery limit.
- Property line noise
- Work area noise

Benefit

- Client's noise requirement is checked and if required counter measure is recommended



Acoustic Induced Vibrations

- Predict acoustic fatigue generated in downstream piping of high differential Pressure reducing devices

Benefit

- Analysis report with counter measures and suggestions to avoid fatigue failure in pipe welded joints.



Toyo Engineering India Pvt. Ltd.

Registered Office & H. O.

Toyo House, Lal Bahadur Shastri Marg, Kanjurmarg (W), Mumbai 400 078, India

Tel: +9122 2573 7000 Fax: +91 22 2573 7520 / 21

Email : in.sales@toyo-eng.com Website : www.toyo-eng.com/in

Engineering Office

Toyo Technology Centre, 71, Kanjur Village Road, Kanjurmarg (E), Mumbai 400 042

Tel: +91 22 2573 5000 Fax: +91 22 2573 5842

Branch Office

214, Splendor Forum, Jasola District Centre, Near Apollo Hospital, New Delhi 110 044

Tel: +91 11 4059 1240 Fax: +91 11 4059 1246

Email : in.delhi@toyo-eng.com