ANSYS MECHANICAL COUPLING

Bringing nuclear quality and standards to system simulation.

FLOWNEX® SIMULATION ENVIRONMENT

Flownex® SE can couple to a range of Ansys products opening up a new frontier in co-simulation. This provides the capability of simulating complete and integrated engineering systems fast and accurately.

TYPICAL USES

DESIGN

- Integrate highly complex 3D geometry in system-level design
- Reduce the required number of design cycles
- Design for reduced thermal stresses

ANALYSIS

- Evaluate and compare different design scenarios
- Investigate thermal stress distribution
- Compare effectiveness of fin configurations

OPTIMISATION

- Optimise secondary flow paths in turbo-machinery
- Optimise conduction geometry to reduce material temperatures

DETAILS & CAPABILITIES

CO-SIMULATION

- Flexible coupling between Ansys and Flownex:
  - Directly couple to Fluent/CFX/Mechanical
  - Using workbench integration
  - Exporting Flownex simulations as FMUs

DIGITAL TWINS

- Import 3D ROMs into Flownex:
  - Understand system performance in long transients
  - Real time system performance monitoring and prediction (Digital Twins).
  - Optimize control strategies on full systems

FLOWNEX® SIMULATION ENVIRONMENT Ansys

WORKBENCH INTEGRATION

Flownex® is developed within an ISO 9001:2015 quality management system that is ASME NQA-1 compliant.

WORKS WITH:

- Fluent
- CFX
- Mechanical
- ROM Builder
- Workbench

SUPPORTS:

fmi FUNCTIONAL MOCK-UP INTERFACE

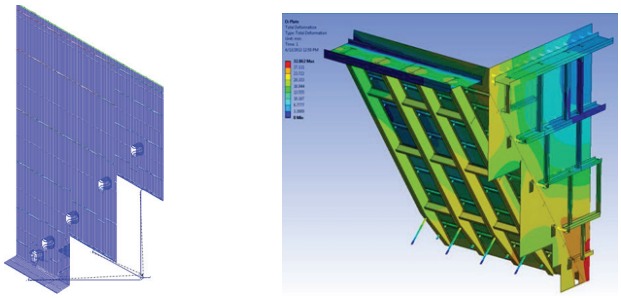
EXAMPLES

LARGE FURNACE THERMAL STRESSES

BOILER MODELLING WITH 3D PRECISION AND 1D SOLVING TIMES

The boiler tubes in a thermal power plant furnace experience a wide range of thermal stresses due to varying loads. It is vital for plant longevity that boiler walls are designed to sufficiently handle with these thermal stresses, especially during start-up conditions.

A co-simulation was created between Flownex and Ansys Mechanical. The Flownex network models the two-phase boiling that occurs in the boiler tube wall. The outer structure of the furnace was modelled in Ansys mechanical.



Flownex model of boiler tube walls and Ansys Mechanical FEA model of the furnace structure.

Temperature distributions from the Flownex network are used as boundary values to the FEA model in Ansys Mechanical. This process ensures that first principles of physics are followed throughout in determining an accurate temperature distribution.

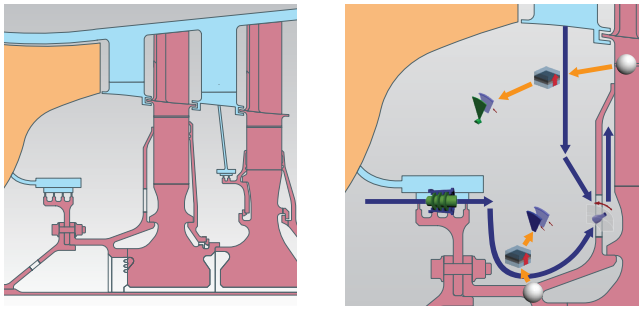
Key locations could be identified where maximum structural stress occurred. This gave engineers insights for better design and the limitations of the boiler's structure under various loads.

SECONDARY AIR SYSTEMS

COOLING AIR AROUND HIGH PRESSURE TURBINE

To ensure that turbine material temperature limits are not exceeded, cooling needs to be accomplished by tapping off secondary air from the compressor.

Flownex was coupled to Ansys mechanical to design and analyse the secondary flow system of a high pressure turbine. The secondary flow was simulated using rotating components in Flownex coupled to astructural model in Ansys Mechanical to calculate the wall temperatures and conduction heat transfer through the turbine blades, cavities, and seals. This coupled solution is used to evaluate whether the secondary flow is sufficient to cool material to within acceptable limits.



KEY CO-SIMULATION APPLICATIONS:

- Turbine blade analyses under various loads
- Pipe header design with accurate temperature distribution profiles from Flownex
- Complex fin geometry for cooling applications