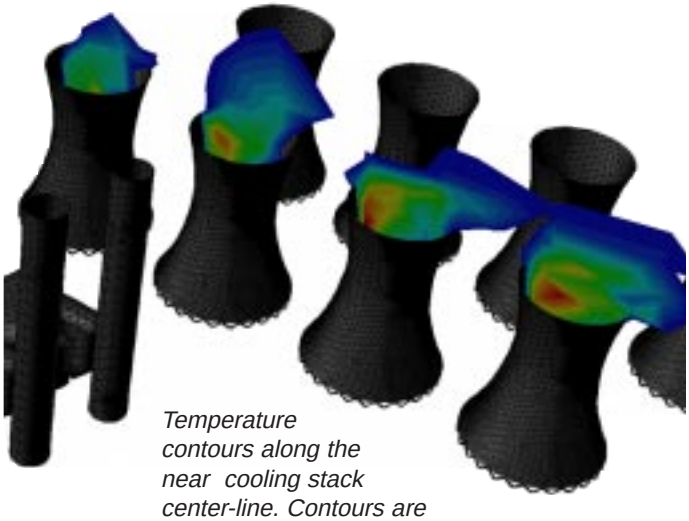
Atmospheric plume dispersion from a cooling tower

EX4

Features Demonstrated

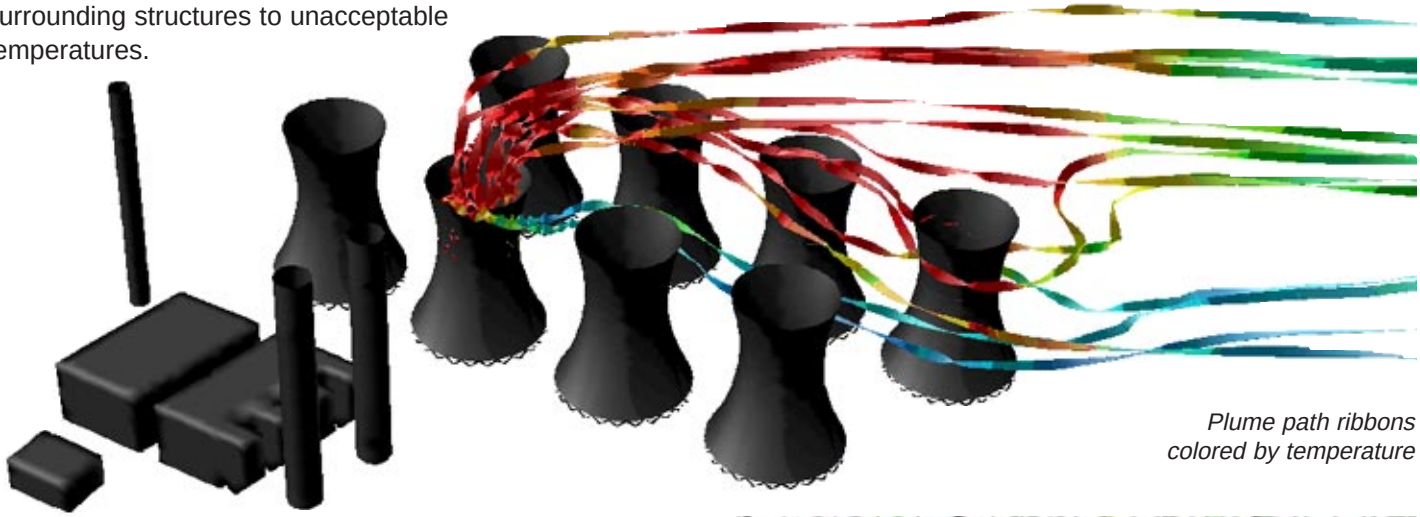
- External flows around complex geometries
- Atmospheric plume dispersion
- Prediction of fluid forces on structures

FLUENT/UNS is used here to model external flow around a complex group of structures including powerplant buildings, exhaust stacks and cooling towers. The prediction of the plume trajectory and its interaction with the surrounding structures quantifies the rate of plume dispersion and the aerodynamic and thermal loads on the structures. Steady flow conditions are considered here, while the unsteady aerodynamic loading on the buildings due to vortex shedding can be predicted using time-dependent simulations.



Temperature contours along the near cooling stack center-line. Contours are clipped between 320K and 350K for clarity.

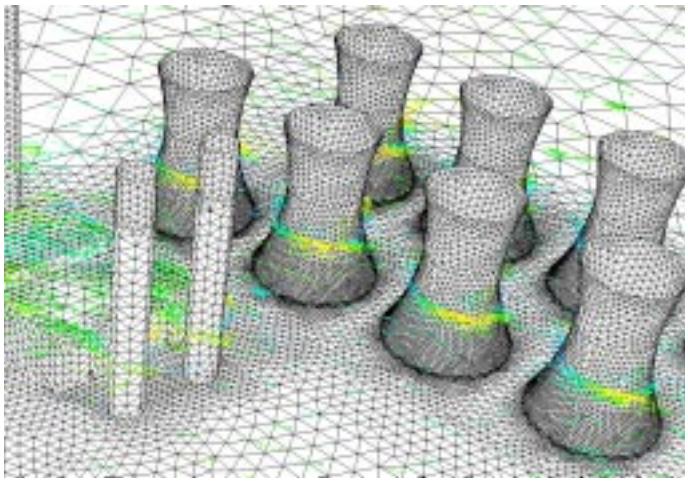
Steam at 600K exhausts from the cooling tower into the atmosphere. Under certain prevailing wind conditions, the plume may be inadequately dispersed and heat the surrounding structures to unacceptable temperatures.



Plume path ribbons colored by temperature

The flow ribbons shown here, colored by temperature and twisted by vorticity magnitude, provide a good indication of the complexity of the flow as it dips behind the cooling towers.

The velocity field, as well as the underlying triangular surface mesh, is shown. The re-circulating wake flow behind the cooling towers can be discerned. The unstructured tetrahedral meshing, used here, allows rapid and accurate modeling of this large scale external flow and complex geometry.



Velocity vectors at a height of 10m above the ground

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