Nucor Steel: Heat Transfer in a Caster Mold

Overview
Nucor Steel faces uneven cooling as molten steel passes through the castor mold, thereby causing defects. The team was charged with redesigning the mold’s cooling system to produce even heat transfer across the face of the copper plate the steel passes through. Problem areas were identified with Computational Flow Dynamics analyses. The problem-causing aspects of the coolant system were then redesigned to provide optimal cooling for the system.

Objectives
The team aimed to provide the most cost-effective solution by:
- modifying the restricting geometry of the coolant system to increase flow
- customizing the flow profile in each coolant passage by tuning port inlet sizes
- redesigning the interior of some chambers the water flows through to decrease turbulence

Approach
After visiting Nucor’s site in Blytheville, AR the team identified the best probable solutions to the coolant flow problem.

- 4 concepts were created which met all of the customer’s needs
  - These concepts were weighted with a Pugh concept scoring matrix
  - The final design was chosen to be a combination of the concepts

- The mold and coolant system were modelled and analyzed in SolidWorks
  - Flow Simulation was used to do a preliminary analysis of the system
  - Problem areas were identified and remodelled with proposed design changes
  - A final simulation was performed to confirm that the remodelled system would have the desired effect.

Outcomes
As a result of implementing the proposed design changes:
- Nucor will save $125,000 as a result of this project
- Defects are expected to be reduced by 30%
- Nucor possesses much of the necessary work to do any future modifications which will further reduce defects.