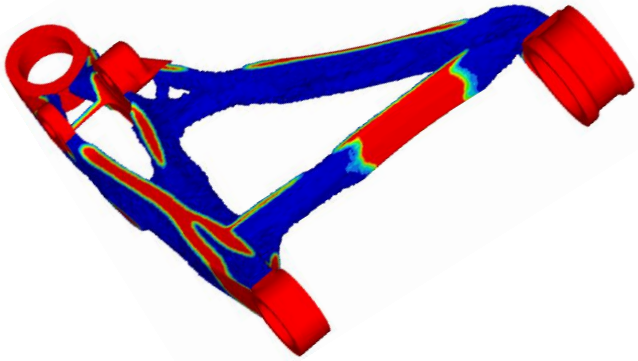
Case Study: Exploiting Additive Manufacturing

Applied Technology Integration

Objective:
- Develop a mass optimized automotive suspension control arm structure that can be sand cast using additive manufactured tooling. Design goal is to reduce mass while maintaining original part performance

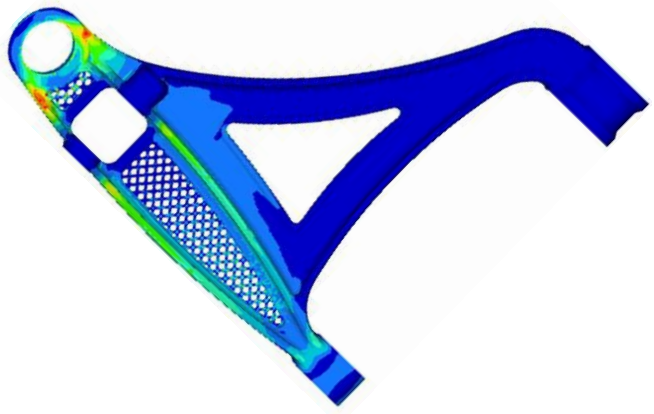
Constraints:
- New control arm must fit in original vehicle package space
- Original part performance requirements must be met
- Tooling must be made using additive manufacturing

Integrated lattice structures



OptiStruct illustration of optimal material placement

Approach:
- The current production component was analyzed to establish a baseline stress profile
- Using the current production design volume limits a maximum allowable space claim model was developed
- Analyzing the model in OptiStruct with fore-aft loads, vertical loads and lateral loads identical to the production component illustrated optimal placement of material to maximize strength
- Areas which are not critical to the performance were examined for opportunities to further reduce weight by exploiting design freedoms available when using additive manufacturing tooling
- Advanced lattice structures were developed for the lower stress regions to further reduce product mass
- Lattice structures were then blended and contoured to integrate into the final product design
- A final stress, deflection and fatigue analysis was performed and compared to baseline to assure there was no negative impact on product performance



Final stress analysis to validate performance

Results:
- Creation of a mass optimized design which could not be produced from normal casting tooling
- Weight reduced by 12% vs current production design
- Performance characteristics maintained
- Successful demonstration of the use of additive manufacturing to eliminate manufacturing constraints on design