Optimization of Overlapping Mesh Calculations for Simulation of Paint Shop Manufacturing Process

Download PDF Version of This Document [1]

Large painting systems like dip or robotic painting systems are generally characterized by their long process time and complex motions. Transient simulation of such systems using CFD resulted in unfeasible computation times and utilized significant computing resources. With the advent of overlapping meshes and motion superposition models, STAR-CCM+ attempted to address the challenges of simulating complex motions. In order to reduce the long computation time associated with such large models and to enhance the effectiveness of overlapping meshes, a new concept was introduced based on the refinement of motion space for robust overset calculations.

Using this concept, the dipping-in process of a complete Body-in-White (BIW) was simulated which identified the air pockets inside the BIW at the end of the dipping process. This involved modeling the motion of a rotating conveyor system and a multiphase calculation for sixty seconds transient time.

A similar overset calculation of the dipping process was used to study the smearing of uncured adhesive joining the components inside an engine hood assembly. In this study, the relative pressure forces acting on every component of the engine hood assembly was computed and mapped to Finite-Element shell model of engine hood which was subsequently used to calculate the relative displacements between its components in Abaqus. Consequently, the design of inner panel of engine hood was optimized to minimize the relative motion, thereby preventing the smearing of adhesive.

Based on the same concept, a flow based robotic top coat painting system was simulated for thirty second transient time. The calculation involved modeling the TCP motion of three painting robots which followed a preprogrammed path and a predefined time plan. To deposit paint on BIW, the atomizer carried by the robots was simultaneously simulated which sprayed lagrangian particles on BIW during the motion. The atomizer?s inlet properties were dynamically controlled using STAR-CCM+ automation capabilities.

Author Company:
MBtech Group GmbH & Co. KGaA
Author Name:
Madhusudhan Devanathan
Industries:
Manufacturing[2]
Products:
STAR-CCM+®[3]

Conference:
STAR Global Conference 2014[4]

CD-adapco is the world's largest independent CFD focused provider of engineering simulation software, support and services. We have over 30 years of experience in delivering industrial strength engineering simulation.

Links:
[1] http://www.cd-adapco.com/sites/default/files/Presentation/SGC%202014%20MBtech%20Madhusudhan%20Devanathan%20for%2
[2] http://www.cd-adapco.com/industries/manufacturing-0
[3] http://www.cd-adapco.com/products/star-ccm%C2%AE
[4] http://www.cd-adapco.com/conference/star-global-conference-2014