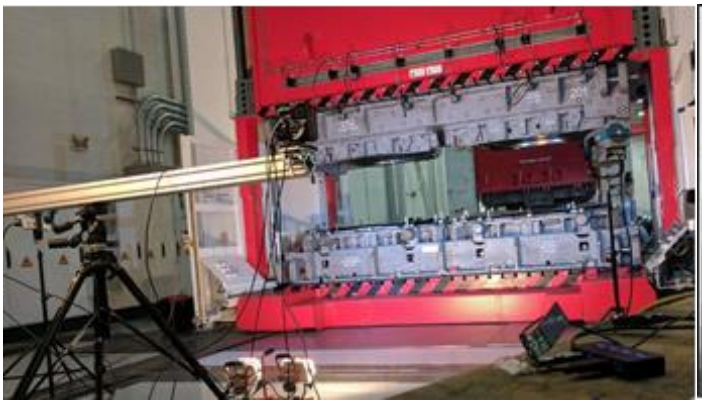


Figure 1 Dot markers placed on a press

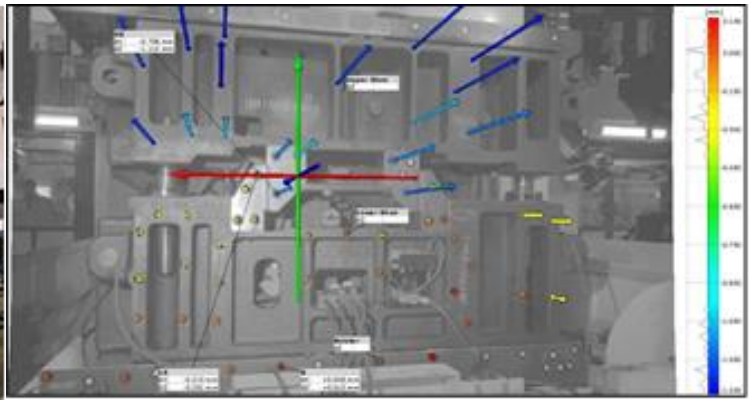


Figure 2 Directional displacements magnitudes

Problem Overview

As the pace and complexity increase in the car market, manufacturing processes, including sheet metal forming (SMF), must advance in sync with these developments. The SMF has been simulated (FE) for the past couple of decades, but the die and press elasticity was not included. Optical Metrology allows for full-field data acquisition to show complex press and die deformations as well as dynamic effects arise and influence the forming results.

Notes

The optical metrology tool, ARAMIS 3D DIC, combined with a pair of high-speed cameras, was used to determine the global displacements of the press and die during operation. 3D-coordinates and 3D- displacements are attained by placing high precision dot targets at different positions of interest, (Figure 1). A rigid body motion correction (upper shoe for top part and bolster for the lower part) was applied to see the actual resultant motion in both lateral and out of plane directions (Figure 2). On Figure 3, the cutting tool displacements and resulting velocities, at 100 stroke/min, are presented as a function of time. At the end of a part (hood) stamping at 750 fps, resulting displacements with characteristic peaks at certain points (at 1s) are shown on Figure 4. Consequently, DIC measurements, combined with a CAD model will serve for reverse modeling and improve computer simulation prediction.

Conclusion

ARAMIS was able to track very small global press and die displacements, on the order of microns. Traditional tools are not able to solve this, so ARAMIS provides the better, or in most cases, the only solution. DIC measurements have immense potential to improve simulation results and reduce the lead time of stamping dies. Last but not least, improved production support and die design are other areas that can benefit from these tools.

Keywords: DIC, Press Deflection, Sheet Metal Forming, High Speed Cameras

Figure 3 Out of plane displacement and velocities time history

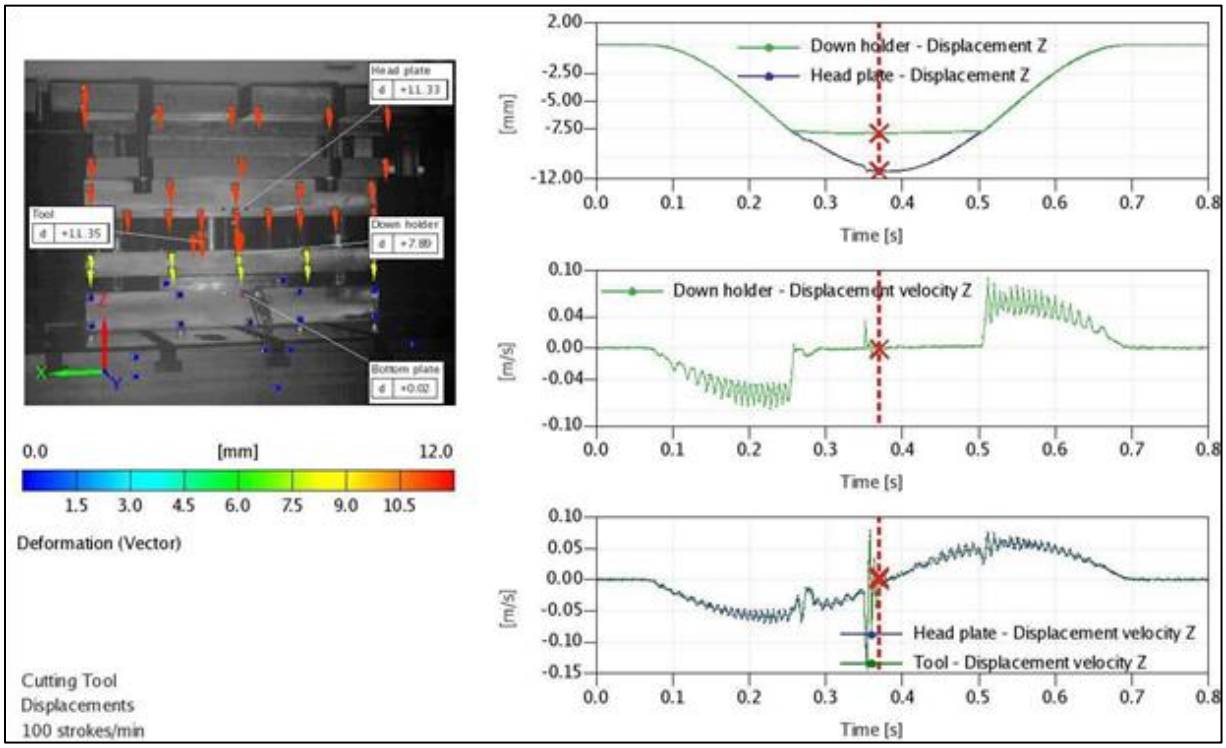
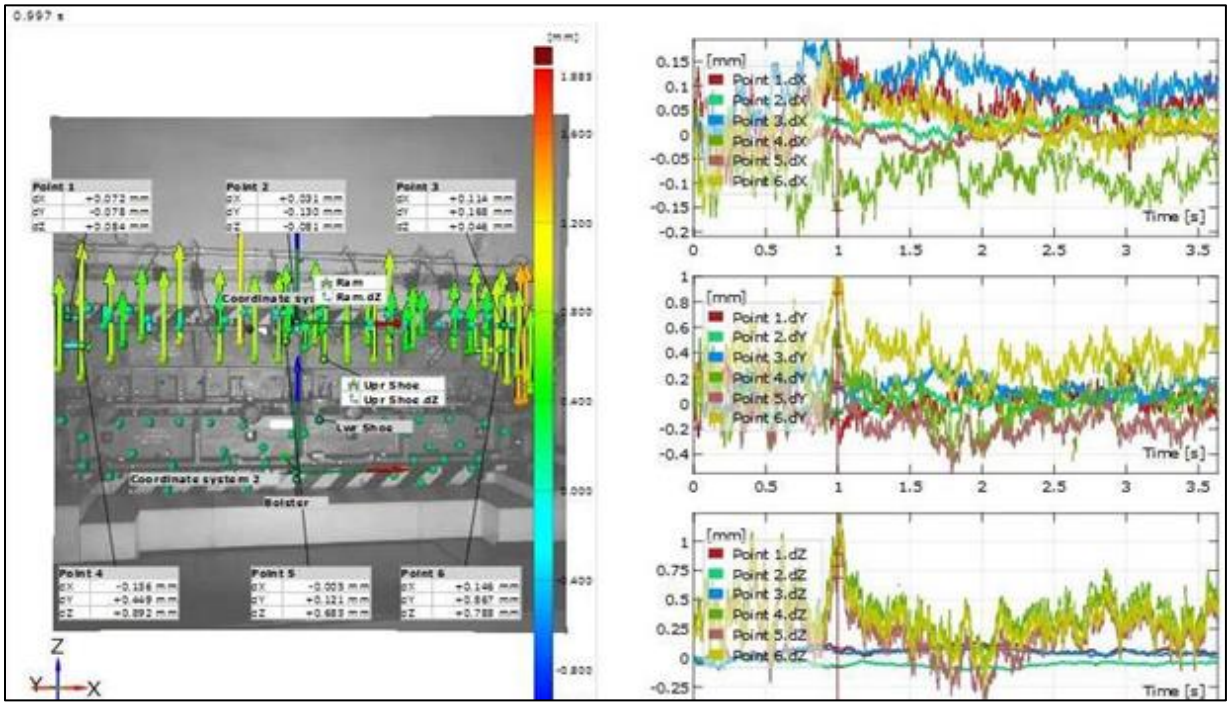


Figure 4 Displacement at 750fps-Hood Part



Keywords: DIC, Press Deflection, Sheet Metal Forming, High Speed Cameras