Entire View on Distortion Compensation for the Assembly of Welded and Stamped Sheet Metal Parts

Dr.-Ing. Tobias Loose
Dipl.-Ing. Jens Rohbrecht

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Our Business

- Process Optimization
- Distortion Compensation
- Quality Optimization
- Heat Treatment
- Welding
- Hotforming
- Distortion
- Residual Stress
- Metallurgy
- Crack And Strength
- Material Management

DynaWeld is more than 20 Years of experience in simulation of all kinds of thermal related manufacturing and material processes

Consulting And Research
DynaWeld's Development

**DynaWeld®**
- Preprocessor
- Environment And Material Data Manager
- Welding, Heat Treatment, Forming
- High Sofisticated Simulations
- **Simulation of Assembly**

**MatplusHQ**
- Simulation Tool
- Pre- Postprocessor And Solver
- Heating And Quenching
- Very Easy Usage For Everyone

**Development - Training - Support - Customer related software solutions**
Material properties and material model for welding analysis needs to take into account thermal dependent behaviour, in certain cases the metalurgical behaviour too.

Apart from expensive measurements a material simulation can provide the necessary data too.

DynaWeld Material provides import of JMatPro data from material simulation.
Distortion by Welding
Forming Simulation after Welding Simulation
Welding Simulation after Forming Simulation

The old state of the art

• Forming simulation and optimization of forming process
• Welding simulation and optimization of welding process

The new state of the art

• Assembly simulation and optimization of the manufacturing process

Assembly Simulation:

• take into account imperfect geometry of assembled parts
  – imperfect forming specimen - geometry definition by simulation
  – imperfect forming specimen - geometry definition by measurement
  – imperfect subassembly - geometry definition by simulation

• take into account
  – deformation due to clamping of imperfect parts
  – deformation due to welding

• Enables the integrated view of process
  – optimization at stages with highest compensation effort
The assembly simulation takes into account prior stages

Assembly procedure

Part 1 + Part 2 + Part 3

Assembly 1

Welding Simulation

Distorted Assembly 1

Part 4 + Part 5 + Part 6

Assembly 2

Welding Simulation

Distorted Assembly 2
Simulation of Assembly

Assembly procedure

- Distorted Assembly 1
  - distorted geometry
  - initial strain/stress
  - welding contact status
  - temperature distribution

- Distorted Assembly 2
  - distorted geometry
  - initial strain/stress
  - welding contact status
  - temperature distribution

- Part 7
- Part 8

Distorted final Assembly

Welding Simulation
Simulation of Assembly

Assembly procedure

Step 1: Welding 1, 2 weld seams

Step 2: Assembly, adding a stiffening plate

Step 3: Welding 2, adding 2 new weld seams
Example of Assembly Simulation
DynaWeld Car: Welding process of the roof

DynaWeld Car: Motion of the clamping tools
DynaWeld Car: Z-Distortions before unclamping

DynaWeld Car: Z-Distortions after unclamping and cooling

Assembly Example - Car Roof
Conclusion

Distortion Analysis Welding
• finding the reasons for certain distortion evolution
• virtual testing of variations

Best practice would be the application of simulation in earlier states for:
• approuvement of the prearranged production
• intervention in early states of development, if tolerances are not reached or visible distortions problems appear

Assembly Analysis and integrated view of manufacturing
• Difference from target geometry by entire process
• Identification of the significant manufacturing steps for distortions and deviations for targeted intervention
• Design of compensation method
• Approval of compensation method or
• Approval of new designed manufacturing process
Thank you very much!