

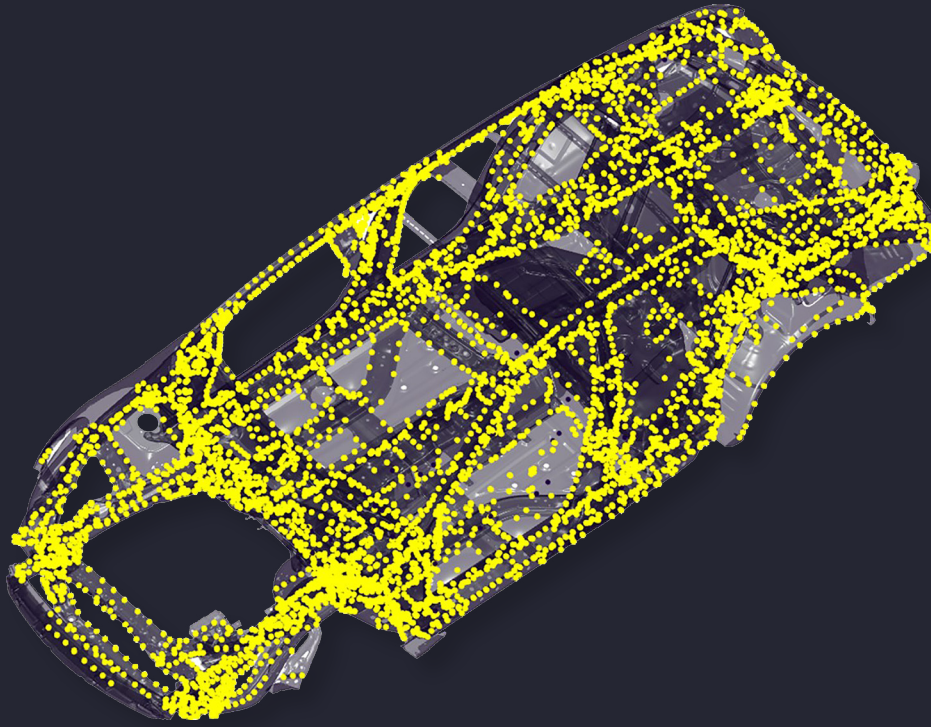
Joining & Assembly

Master Local Joining Performance in Body & Chassis Manufacturing

Prevent Unexpected Spot Weld Rupture and Boost
Operational Efficiency



Virtual Manufacturing Solutions | Brochure



In manufacturing, achieving the right spot weld quality with a safe and robust process is crucial. Traditional physical-based testing is time-consuming and costly, often limiting the testing to a few key configurations when almost infinite combinations of material types, grades and thickness can occur.

And with increasing CO2 emission regulations forcing OEMs to integrate even lighter and stronger materials, resulting in more complex body designs with more material types and grades, an increase in the number of unique configurations is inevitable.

Revolutionizing Weld Quality & Performance Evaluation with Cutting-Edge Simulation Software

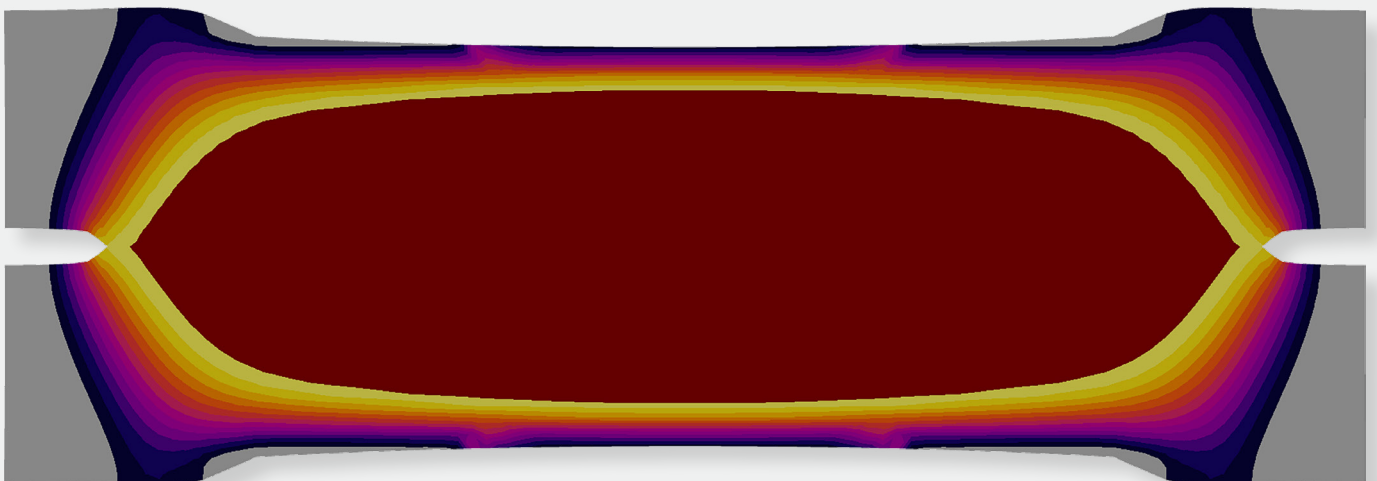
Virtual spot weld quality and rupture analysis transforms this process, enabling the testing of numerous combinations and variations efficiently.

A streamlined and intuitive workflow, in one single environment, allows engineers and cross-disciplinary teams to virtually evaluate spot weld processes and strength, addressing real-

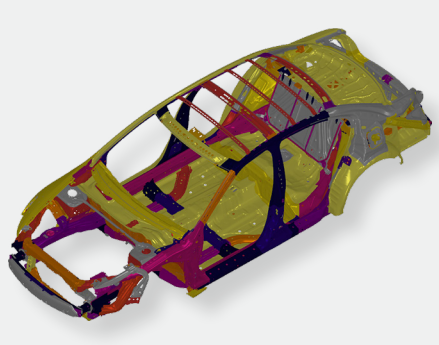
world manufacturing and crash performance challenges related to weld process window, quality, and strength.

By integrating multi-physics spot welding process simulation combined with connection strength analysis, unlimited exploration of weld parameters and material-thickness combinations become possible.

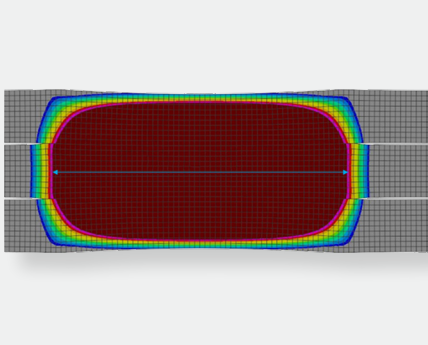
This approach minimizes reliance on costly, time-consuming and non-scalable physical testing, allowing users to evaluate weld quality and strength more efficiently and accurately in the virtual world.



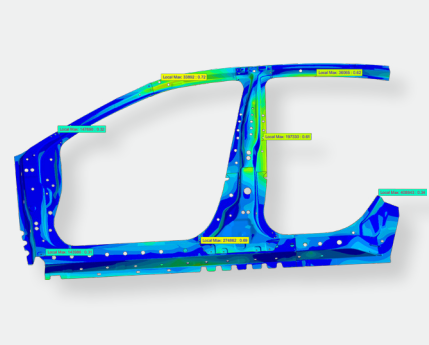
Key Applications:



Define and validate the **spot weld process** connecting up to four components.



Verify spot weld quality,
e.g. spot weld nugget radius
and height, microstructure,
heat affected zone and
hardness.



Determine a valid process window by performing a weld-lobe analysis through standard or reduced-order modeling.

**Avoid spatter risk by
optimizing process
settings.**

Assess the spot weld strength through **various integrated coupon specimens**, like T-Tension, Cross-Tension and Lap Shear tests.

Visual-Viewer 2024.0 - Home Page

Applications File Edit View Insert Results Sections Curves Plots Drawing Injury Report Tools Window Help

Search commands

SpotWeldRuptureWorkflow Exp File Explorer Part

Stack Definition

Number of Sheets: 2

Stack Description:

- 2 Electrodes
- 2 Sheets
- 3 Interfaces
- Limited to 4 Sheets Stack

Sheet 1: Un-Coated
Sheet 2: Un-Coated

Electrode Definition Sheet Definition

Item	Thickness	Material
Sheet 1	1.52	DP100_FORD
Sheet 2	1.52	DP100_FORD

Define the thickness of each Sheet
Thickness of Sheet 1 is defined
Thickness of Sheet 2 is defined

Preview Stack

Custom Coating

	Electrical	Thermal
Top Electrode-Sheet 1	ECR_E-S_Coated...	TCR_E-S_Coated...
Sheet 1 Sheet 2	ECR_S-S_Coated...	TCR_S-S_Coated...
Bottom Electrode-Sheet 2	ECR_E-S_Coated...	TCR_E-S_Coated...

☐ Adhesive Coating Definition:

Acceptable Nugget Diameter: 6.164 mm
Predicted Nugget Diameter: 8.1295 mm @ 1500.0 Deg C
Acceptable Nugget Height: 0.2 mm
Predicted Nugget Height: 1.083194 mm
Spatter Risk: No Risk
Depression: Acceptable < 25%
Nugget Quality Validation: OK

Remark:
-No Spatter Risk=>
Applied Force > Max Force in Molten Zone

Force (N) (e+03) vs. Displacement (mm)

LS Numerical F.D.

Num. F.D.

X=5.22172 Y=1890.79 T=0.00524462

Enhancing Weld Excellence: Key Values of ESI's Joining Simulation Software for Local Joining Performance

Increase Testing Scalability:

Offers an easy scalable process by applying **virtual modeling** and analysis and allows for a broader exploration of the operating process window by investigating multiple process variations.

Guarantee a Safe Welding Process:

Eliminate spatter risk by using safe process settings.

Establish Fast Feedback Loops:

Answer questions about **weldability and strength** for new material combinations within hours instead of weeks.

Support Innovation through Exploration of Novel Materials:

Accurately test state-of-the-art **lightweight materials** and draw fast conclusions about weldability and connection strength.

Minimize Try-Out Risk: Avoid unexpected rupture in (especially) high strength steels by **accurate determination** of the connection strength level by taking into account the heat affected zone, which could cause softening of the material around the spot weld of the high strength material around.

Analyze Weld Quality & Strength Without Destructive Testing:

Analyze in detail microstructure, nugget diameter and height and determine force-displacement curves with just few mouse clicks.

Enhance the Crash Performance Predictiveness:

Ensure each unique spot weld configuration is accurately tested and corresponding force/displacement behavior is derived, drastically increasing the **predictiveness of crash performance** simulations, allowing to reduce the amount of over-engineering to a minimum by minimizing material thickness, aiding in weight reduction.

	0.2	0.225	0.25	0.275	0.3
1.7	2.530	2.628	2.726	2.781	2.825
1.2	2.487	2.590	2.631	2.688	2.727
1.7	2.392	2.490	2.533	2.628	2.632
1.2	2.294	2.392	2.489	2.492	2.588
1.7	2.237	2.296	2.338	2.396	2.396

Force 1,6 kN

	0.2	0.225	0.25	0.275	0.3
1.7	2.526	2.623	2.718	2.774	2.816
1.2	2.427	2.578	2.624	2.717	2.721
1.7	2.386	2.523	2.580	2.622	2.679
1.2	2.327	2.425	2.484	2.525	2.580
1.7	2.285	2.328	2.425	2.428	2.484

Force 2,1 kN

	0.2	0.225	0.25	0.275	0.3
1.7	2.517	2.616	2.715	2.766	2.813
1.2	2.421	2.573	2.615	2.674	2.766
1.7	2.419	2.477	2.572	2.614	2.670
1.2	2.322	2.419	2.516	2.518	2.613
1.7	2.225	2.322	2.418	2.476	2.515

Force 2,6 kN

Discover how ESI's Joining Simulation software (SYSWELD) can be used to validate your spot welding process and assess the connection strength.

Welding & Assembly Simulation Software:

