

Aufbau und Kontrolle von LS-Dyna Modellen in HyperCrash

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## **Graphical User Interface**





## **Safety Tools**





#### <u>WebEx</u>

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### **Model Checker**

🛃 HyperCrash 11.0 430 HC110_430_2 (64 bits) - LS-DYN	IA - mn	n,Mg,s - : F
File Quality Connections Mesh Editing Mass Model Lo	adCase	Lsdyna To
	@. •	E 🏝 ₽
Tree Browser ModelChecker ×		
Check	Nb/Val.	Level
NULL Young modulus	1	Error
Node connected to more than 6 shell elements	652	Warning
Free Nodes	6	Warning
Unused Set Node	5	Warning
Contact: Friction not well defined	2	Warning
Unused Materials	6	Warning
Only one Part	4	Warning
Double ID's of EOS	0	Info
Double ID's of Accelerometers	0	Info
Double ID's of Wolding lines	٥	Info

- Global model check with automatic fix tools to avoid modeling errors
- Individual checks can be added by a config file



Rho /MODCHK/CORRECTION/ModifyManually Modify Density	
 MODCHK/CHECK/ERROR/CheckNullE/MAT NULL Young modulus E = 0 /MODCHK/CORRECTION/ModifyManually Modify Manually	
<pre># /MODCHK/CHECK/ERROR/CheckNullRho/MAT NULL Density RHO = 0 /MODCHK/CORRECTION/ModifyManually Modify Manually</pre>	с Г



## **Replace Parts and Assemblies**



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## \*INCLUDE\_TRANSFORMATION

barrier.k						
ID		1				
OFFSET NODE		1000				
OFFSET ELEMENT		1000				
OFFSET PART & RB		0				
OFFSET MATERIAL		0				
OFFSET SET		0				
OFFSET FUNCTION		0				
OFFSET DEFINE EXCEPT FUNC	TION	0				
OFFSET DEFAULT		0				
Write DYNA.INC File						
Transformations		[1]				
DEFINE_TRANSFORMATION						
		1				
Number of transformations		2				
<ul> <li>Number of transformations</li> </ul>						
Transformations - 1		[1] INCLUDE TRANSFORMATION				
Transformations - 2		None				
ROI		2				
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	ick Point	Galler				
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.* B	etween 2 points					
/. c	ircle center					
S	elect single coordinate					
Save R	estore All Values	Cancel				
		J=				



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Include files with transformations (translation, rotation, scale) can be defined and managed in HyperCrash





## \*PARAMETER



HyperCrash 11.0 430 HC110_430_2 (6-         File       Quality         Connections       Mesh Editing         Image: Connection set in the set in t	4 bits) - LS-DYNA - mm,N Mass Model LoadCase L	Define a parameter (e.g. initial velocity) in the Parameter Browser				
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🤨 📾 🔒 1 &velo FLO	AT		*; *; *	5 🖍 🖏 👘		
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Title*	&velo	R				
Parameter value	15650		GENERATION			
	ID		2			
Select this parameter in	[STYP] Set type*		1: By part set			
the lead eace definition	[ID] Part set		[2001656]			
the load case demition.	[OMEGA] Angular velocity	about the rotational axis	0			
	[VX] Initial translational vel	ocity in global x-direction	(&velo) 15650	Disassociate Parameter		
	[VY] Initial translational ve	locity in global y-direction	ocity in global y-direction 0 Celest Des			
	[VZ] Initial translational vel	ocity in global z-direction	0	Cancel		
	[IVATN] Initial velocities of	slave nodes and parts	0: Slave parts			
	[ICID] Local Coordinate Sy	stem for velocity and rotational axis	None			
	IVCL v coordinate on rotati	onal avia	0			

## Connections

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- Solid spotwelds: single HEXA or a cluster of 4, 6, 8, 12 and 16 combined solids
- · Continuous glue modeling with different number of elements in width and height



Glue with continuous hexa modeling



Spotwelds with 1,4, 8, 12 or 16 cluster of solid elements

# Material and Property Data (BOM Data)

X	Image: Section 1     Image: Section 1     Image: Section 1     BOM_DATA_semil.csv - Microsoft Excel       Datei     Start     Einflügen     Seitenlayout     Formeln     Daten     Überprüfen     Ansicht     PDF       J1     Image: Section 2     Image: Section 2     Image: Section 2     Image: Section 2     Image: Section 2									
D	atei Start Einfü	gen Seitenlay	out Formeln Daten Überpi	üfen Ansicht	PDF					
	J1 🔻	r (* fa	Thickness							
	Α	В	С	D	E	F	G	Н	1	J
1	\$Part Assembly	Cad part no	Part name	Cae part id	Target mass	Assembly	Assembly id	Material name	Section name	Thickness
2	0		109-bw-floor-rear	2000001	0			MAT_PLASTIC	bw-floor-rear	0.823
3	0		int-trans-access-cover	2000002	0			MAT_PLASTIC.141	int-trans-access-cover	0.89
4	0		bw-floor-front	2000003	0			MAT_PLASTIC.142	bw-floor-front	0.962

Define BOM data (material and property settings) in an Excel file

All BOM data is assigned automatically in HyperCrash



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	BOW_DATA.csv
	BOM_DATA_semi.csv
includefiles\	
C:\	
D:\	
E:\	
	•
Tasks to be performed:	
Generate Assembly Structure	More Info.
Link Material	
Link Property	
Assign Thickness	
Location for Material and Property to	link Part Identification Criteria
Global Database	▼ CAE Part Name ▼
Files of type :	
CSV Files(*.csv) 👻	
Selection: D:\home\alscher\KONFER	ENZEN\Dyna_UIm_2012\Modelle\Explorer_neu_includ
Selection: D:\home\alscher\KONFER	ENZEN/Dyna_UIm_2012\Modelle\Explorer_neu_includ

## **LS-DYNA Mass Calculation**

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- · HyperCrash offers an accurate mass calculation for LS-DYNA
- Mass information reported following LS-DYNA d3hsp file format structure:
  - Total Mass
  - Part Mass
  - Structural Mass
  - Nonstructural Mass
  - Lumped Mass

Parts								
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Mass COG Inertia								
Entity	ld	Total mass	Part mass	Structural mass	Non structural mass	Lumped mass	Target mass	Delta mass
V 📕 MODEL		1.132769116E+004	1.132769119E+004	6.793114796E+002	1.130538309E+004	1.20000000E+001	0.00000000E+000	1.132769116E+004
▽ 📴 U222_Seat.dyn	0	1.132769119E+004	1.131569119E+004	6.793114796E+002	1.130538309E+004	1.20000000E+001	0.00000000E+000	1.132769119E+004
🗹 🗢 side_2dbelt	1	3.730487520E+003	3.730487520E+003	6.791655819E+002	3.730487400E+003	0.00000000E+000	3.94000000E-004	3.730487126E+003
bolt_10.0mm	2	8.000012284E+000	1.228365600E-005	2.117582368E-021	0.00000000E+000	8.00000000E+000	8.20000000E+000	-1.999877163E-001
🗹 🗢 baem_30mm_locked	3	1.315908787E+001	1.015908787E+001	0.00000000E+000	0.00000000E+000	3.00000000E+000	0.00000000E+000	1.315908787E+001
🗹 🗢 Ball2_R_Front_i	4	1.057299193E-007	1.057299193E-007	1.057299193E-007	0.00000000E+000	0.00000000E+000	0.00000000E+000	1.057299193E-007
Ball2_R_Front_i_I	5	1.057329854E-007	1.057329854E-007	1.057329854E-007	0.00000000E+000	0.00000000E+000	0.00000000E+000	1.057329854E-007
🗌 🗢 Ball2_R_Front_o	6	1.052302717E-007	1.052302717E-007	1.052302717E-007	0.00000000E+000	0.00000000E+000	0.00000000E+000	1.052302717E-007
Ball2_R_Front_o_I	7	1.052323486E-007	1.052323486E-007	1.052323486E-007	0.00000000E+000	0.00000000E+000	0.00000000E+000	1.052323486E-007
🗌 🔵 Ball2_R_up_Front_i	8	6.072458493E-008	6.072458493E-008	6.072458493E-008	0.00000000E+000	0.00000000E+000	0.00000000E+000	6.072458493E-008

## HyperCrash - Solver Conversion

- Interfaces to LS-Dyna, Radioss and PamCrash
- Powerful conversion framework based on engineering know-how to convert most of the model definitions, material cards and solver parameters

A Material Translation Choi	ce			
2000756 Rigia	RIGID/MAT_020	INTO LAWZ+RBUDY	res	
	RIGID/MAT 020	into LAW2+RBODY	Yes	
Select All Materials	RIGID/MAT_020	into LAW2+RBODY	Yes	
Affect DB Material File	RIGID/MAT_020	into LAW2+RBODY	Yes	
Affect Translated Material	RIGID/MAT_020	into LAW2+RBODY	Yes	
Chasses Material From DR	RIGID/MAT_020	into LAW2+RBODY	Yes	
Choose Material From DB	RIGID/MAT_020	into LAW2+RBODY	Yes	
2000609 springelastic	SPRING_ELASTIC/MAT_S01	into PROP13	Yes	
2000679 MATSD1_20850	SPRING_ELASTIC/MAT_S01	into PROP13	Yes	
2000738 MATSD1_20850	SPRING_ELASTIC/MAT_S01	into PROP13	Yes	
2000741 MATSD1_20850	SPRING_ELASTIC/MAT_S01	into PROP13	Yes	
2000767 NO TITLE	SPRING NONLINEAR ELASTIC/MAT_S04	into PROP13	Yes	
2000768 NO TITLE	SPRING_NONLINEAR_ELASTIC/MAT_S04	into PROP13	Yes	
2000001 MAT PLASTIC	PIECEWISE LINEAR PLASTICITY/MAT 02	4 into LAW36 or LAW1	Yes	
2000002 MAT_PLASTIC	PIECEWISE_LINEAR_PLASTICITY/MAT_02	4 into LAW36 or LAW1	Yes	
2000003 MAT_PLASTIC	PIECEWISE_LINEAR_PLASTICITY/MAT_02	4 into LAW36 or LAW1	Yes	
2000004 MAT_PLASTIC	PIECEWISE_LINEAR_PLASTICITY/MAT_02	4 into LAW36 or LAW1	Yes	
2000005 MAT PLASTIC	PIECEWISE LINEAR PLASTICITY/MAT 02	4 into LAW36 or LAW1	Yes	
4			•	
Ok			Cancel	
			ouncer	



- New ID view to manage ID's for Include/Module
  - · List ID range definitions in the module/include tree structure
  - Columns added to list to show defined ID Range , Occupied ID range, Overflows, correction option, New ID option

Utility   Mask   M	/odel	ld Pool							
Entities	ID	Min ID	Max ID	Min ID occupied	Max ID occupied	#Entities	#Overflow	New Id	Correction Option
r 📬 doors.k	1	-	-	-	8000006	63508	-	Max available	Compact And Fit
😋 mass.k	2	-	-	-	2000020	12	-	Max available	Compact And Fit
🕂 📢 wheels.k	3	-	-	-	2508253	14960	14929	Max available	Compact And Fit
- 🙀 Elements		1000	20000	15	234854	8096	8096		Compact And Fit
- 🙀 Nodes		100	200	2000002	2508253	6796	6796		Compact And Fit
- 🗞 Compone	nts	1000	500000	2000002	2000014	13	13		Compact And Fit
- 🌆 Materials		100	200	2000002	2000013	12	12		Compact And Fit
- 🔊 Properties	6	100	200	71	82	12	12		Compact And Fit
- 🥰 explorer_BIW	/.k 4	-	-	-	8000004	253418	-	Max available	Compact And Fit
- 🥰 suspen.k	5	-	-	-	757440	14022	- 1	Max available	Compact And Fit
- 🥰 engine.k	6	-	-	-	701720	3373	-	Max available	Compact And Fit
🛶 frame.k	7	-	-	-	565001	126780	- 1	Max available	Compact And Fit

Version 12.0

HyperWorks

## Advanced Meshing: Transfer to HyperMesh





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### **Stamping Results in Crash Analysis**

Validation with Test Data (PSA, Altair EHTC 2010)



## **Stamping Results - Option 1**

#### Map incremental analysis results

- Use accurate incremental stamping analysis with adaptive mesh followed by mapping of results to structural mesh
- Need stamping experts to define a feasible process which is difficult at the early product feasibility phase
- Time consuming to run large number of parts
- Possibility of error from mapping between somewhat different geometries

## Stamping Results - Option 1: Results Mapper

- General purpose mapping tool inside HyperCrash
  - Map thickness, plastic strain, stresses, fiber orientation
  - Read forming data from Radioss, Dyna, AutoForm
  - Write mapped data to Radioss, Dyna, Abaqus input format
  - Map results between solids, hydro-formed parts
  - Handle symmetry

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- Fill holes
- Batch process: Save and Replay









## **Stamping Results: Option 2**

#### Use inverse analysis directly on structural mesh

- Use One Step stamping analysis on the structural mesh and directly include the stamping results with the structural model
- Addendum effect needs to be approximated with edge boundary condition
- Possible to run large number of parts within a short time
- Accurate enough for crash analysis

#### Workflow

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initialized with stamping results

Stamping results from One step solver RADIOSS™





## User Interface (HyperCrash)





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### Case Study: Ford Taurus Side Impact Crash Model

 Without stamping
 With stamping

 U r = 500 603
 U r = 1199 9T

 U r = 503 400
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