

OPTISTRUCT FOR LINEAR ANALYSIS, V2019 CHAPTER 7: ADVANCED TOPICS



AGENDA

- 1. Introduction to Linear Analysis
 - Type of Analysis
 - Type of Elements and Materials
 - Type of Loads & Boundary Conditions
- 2. Linear Static Analysis
- 3. Inertia Relief Analysis
- 4. Modal Analysis
- 5. Linear Buckling Analysis
- 6. Thermal Stress Steady State Analysis

- 7. Advanced Topics
 - Debugging Guide
 - Parameters
 - Transitioning Elements
 - Introduction to Parallelization
 - Run Options
 - Output Management
- 8. Optimization in Linear Analysis
 - OptiStruct Optimization
 - DRCO Approach
 - Setting up Optimization
 - Optimization Responses for Linear Analysis

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DEBUGGING GUIDE



GENERAL SANITY CHECKS

- Does a checkrun complete successfully (-check)?
- Are there any relevant warnings in the .out file?
- Does the model checker in HM show any issues (Tools \rightarrow Model Checker)?
 - Check for any modeling errors (mesh discontinuities)
- Are the units consistent (mass, applied forces, etc. in the .out file make sense)?
- Does Groundcheck complete successfully (GROUNDCHECK Subcase Information Entry)? Check the element IDs for which the test fails.
- Plot animation (scale) will shown an mistakes in engineering judgement.
 - Missing boundary conditions or loading conditions
 - Material and property definitions
 - Element quality
 - Mass properties

GENERAL SANITY CHECKS

- Does a normal modes analysis show any issues? The number of rigid body modes should be as expected.
 - If free-free, are there six "rigid-body" (freq=0.0) modes?
 - Are there any mechanisms (freq=0.0)?
 - More than six "rigid-body" modes in free-free?
 - Any "rigid-body" modes in constrained modes?
- Is force balance satisfied (epsilon in out file)? Epsilon should be numerically zero.
 - Epsilon > 10E-9 may indicate trouble
- Check load paths use grid point force balance to "trace" loads
 - Check stress contours for "consistency"
 - "Sharp" corners indicate bad modeling
 - Check stress discontinuities
- Try different memory options such as

-core in, -core out, -fixlen xy, -len xy, -maxlen xy

DEBUGGING FOR NORMAL MODES ANALYSIS

- Try AMSES (EIGRA) and LANCZOS (EIGRL) are results comparable?
- Try AMLS (EIGRL and PARAM, AMLS, YES) if available
- Try LANCZOS with PARAM, AMLS, 2 to enforce constraint reduction
- AMSES and AMLS will catch massless mechanisms automatically. It also outputs and constrains those DOFs
- Check if upper bound on EIGRL/EIGRA card is reasonable
- Try a non-blank for ND, V1 and V2 on EIGRL/EIGRA card
- Try small V2, e.g. 10 Hz (models with low ND but high V2 might still fail due to too many modes)

DEBUGGING FOR INERTIA RELIEF ANALYSIS

- When comparing two models with PARAM, INREL, -2 note that the models should
 - Have the same stresses and compliance
 - But not necessarily the same displacements

DEBUGGING FOR BUCKLING ANALYSIS

- Buckling is a very sensitive analysis. Even if the linear static run seems fine, small modelling issues can become apparent in buckling analyses.
- Run normal modes and make sure there are no rigid body modes.
- **Try** PARAM, SHPBCKOR, 2
 - order of approximation used in plate bending geometric stiffness for linear shell elements
 - For 2, no transverse shear considered, only bending. Better for thin shells

DEBUGGING FOR HEAT TRANSFER ANALYSIS

- Nodal temperature input is defined thru SPC w/o dofs
- CHBDYE **definition**
- Temperature dependent conductivity only works with NLHEAT
- TABLEM1 in MATT4 defines multipliers, not actual conductivity
- Conductance/area is required in PCONTHT since v14.210

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PARAMETERS



INTRODUCTION PARAMS

Parameters along with the parameters values are used generally in the Bulk Data entries to manage or control or requesting special features.

These Parameters are address with the command "PARAM" and these are classified here by the following:

- Sub-case
- Material
- Element
- Loads
- Output

PARAMETERS FOR DIFFERENT SUBCASE TYPES

Subcase Type	Output options	PARAM
LINEAR STATIC	DISPLACEMENT, ACCELERATION, STRESS, STRAIN, GPFORCE, GPSTRAIN, GPSTRESS, OLOAD, SPCF, PRESSURE, MPCFORCES	AUTOMSET, AUTOSPC, BUSHRLMT, BUSHSTIF, BUSHTLMT, COMP2SHL, CURVSHL2, ELASRLMT, ELASSTIF, ELASTTLMT, CHECKEL, CHECKMAT, CHKELSET, GRDPNT, GE_MOD
MODES	DISPLACEMENT, STRESS, STRAIN, GPFORCE, GPSTRAIN, GPSTRESS, OMODES	AMLS, AMLSMAXR, AMLSNCPU, AMLSUCON, AMSES, AUTOSPC, CHECKEL, CHECKMAT, CHKELSET, AUTOMSET, BUSHRLMT, BUSHSTIF, BUSHTLMT, COMP2SHL, CSTEVAL, ELASRLMT, ELASSTIF, ELASTTLMT, CHECKEL, CHECKMAT, CHKELSET, GRDPNT, GE_MOD
Inertia Relief	DISPLACEMENT, STRESS, STRAIN, GPFORCE, GPSTRAIN, GPSTRESS	AUTOSPRT, INREL, REFPNT, UCORD
BUCKLING	DISPLACEMENT, ACCELERATION, STRESS, STRAIN, GPFORCE, GPSTRAIN, GPSTRESS, OLOAD, SPCF, PRESSURE, MPCFORCES	AUTOMSET, AUTOSPC, BUSHRLMT, BUSHSTIF, BUSHTLMT, COMP2SHL, CURVSHL2, ELASRLMT, ELASSTIF, ELASTTLMT, CHECKEL, CHECKMAT, CHKELSET, GRDPNT, GE_MOD, CHECKEL, CHECKMAT, CHKELSET
THERMAL	THERMAL, OLOAD, SPCF	THCNTPEN



PARAMETERS FOR ELEMENTS, MATERIALS, OUTPUT

	PARAM
Element Specific	AMSE4CMS, CHECKEL, CHKELSET, CURVSHL2, EXCOUT, FLIPOK, KGRGD, NPRBAR, NPRBE2, RBE2FREE, RBE3FREE, RENUMOK, SHL2MEM, SHPBCKOR, TOLRSC, XPOST
Material Data Specific	PRESUBNL, OMID, MDK4OPT, CHECKMAT, ALPHA1, ALPHA1FL
Output Specific	AMLS, CMSALOAD, FLLWER, XPOST, EFFMAS, EXCEXB, EXTOUT, GPSLOC, ITAPE, OGEOM, POST, PRGPST, STRTHR, UCORD

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TRANSITIONING ELEMENTS



INTRODUCTION TRANSITIONING ELEMENTS

When performing analyses of complex components or systems, the issue of connecting dissimilar mesh types often arises. Accuracy and efficiency are two conflicting aspirations and so analysts are often forced to use different types of elements in a single model. Due to limitations of recourses, analysts generally need to implement aggressive idealizations on their analysis models. When used correctly, transitioning can provides major cost savings while retaining quality of results. Transitioning schemes fall into two main categories.

- 1. Transitions from one element type to another that are of the same dimension (e.g. both are shell or solid elements).
- 2. Transition is where element of different dimension are joined (e.g. a shell to solid transition).

Dimensional reduction or model order reduction techniques are oftentimes used to transform a complex 3D or 2D problem into a lower order 1D or 2D system respectively. By doing so, computation times are significantly reduced, but in a way that does not compromise model accuracy. In dimensional reduction, the finite element model makes use of elements of reduced dimension, such as beams, plates and shells.

TRANSITIONING ELEMENTS TYPES

Transitioning Methods	Transitioning Elements	Additional Details			
Interface	Tie Contact	Penalty-based and MPC-based (Lagrange Multipliers)			
	Freeze Contact	Penalty-based			
Gap or Friction Element	CGAP				
Shell-to-Solid Element Connector	RSSCON				
Kinomotio coupling	Rigid Links	RBE1, RBE2, RBAR, RROD			
	Load Distribution	RBE3			

INTERFACE TYPES

Freeze & Tie Contact enforces zero relative motion on the contact surface, the contact gap opening remains fixed at the original value and the sliding distance is forced to be zero. Additionally, rotations at the slave node are matched to the rotations of the master patch.

The FREEZE condition applies to all respective contact elements, regardless of whether they are open or closed.

Two types of TIE contact are available, PENALTY-based and MPC-based. The two types can be switched using CONTPRM, TIE, PENALTY/MPC. The MPC-based TIE uses Multi-point Constraints to define a tied contact between the master and slave surfaces.

COMPARISON STUDY BETWEEN TIE AND FREEZE CONTACT

Free-Free Normal Mode analysis was conducted using a Solid cube & Shell plate FE-model For evaluation these modes are connected using



COMPARISON STUDY BETWEEN TIE AND FREEZE CONTACT

Observe that all the 15 modal frequency match very closely with Merge, compared to Tie & Freeze.

Mode	MERGE	TIE	FREEZE		
1	9.96E-03	9.79E-03	8.86E-03		
2	1.44E-02	1.47E-02	1.34E-02		
3	1.53E-02	1.58E-02	1.48E-02		
4	1.66E-02	1.69E-02	1.54E-02		
5	1.71E-02	1.77E-02	1.63E-02		
6	1.89E-02	1.95E-02	1.92E-02		
7	5.56E+02	5.56E+02	5.54E+02		
8	9.45E+02	9.45E+02	9.43E+02		
9	1.52E+03	1.52E+03	1.51E+03		
10	1.52E+03	1.52E+03	1.51E+03		
11	2.97E+03	2.97E+03	2.95E+03		
12	3.57E+03	3.57E+03	3.56E+03		
13	4.14E+03	4.14E+03	4.13E+03		
14	5.23E+03	5.23E+03	5.23E+03		
15	5.27E+03	5.27E+03	5.25E+03		



RSSCON – SHELL-TO-SOLID ELEMENT CONNECTOR

RSSCON generates a multipoint constraint that models a clamped connection between a shell and a solid element. The shell degrees-of- freedom are considered dependent. The translational degrees-of- freedom of the shell edge are connected to the translational degrees-of- freedom of the upper and lower solid edge.



Mixed dimensioned transition elements

The rotational degrees-of-freedom of the shell are connected to the translational degrees-offreedom of the lower and upper edges of the solid element face. Poisson's ratio effects are considered in the translational degrees-of-freedom.

It is recommended that the height of the solid element's face is approximately equal to the shell element's thickness of the shell. The shell edge should then be placed in the middle of the solid face.

RSSCON is ignored in heat-transfer problems.

COMPARISON STUDY OF RSSCON WITH CANTILEVER MODEL

FE Model Details



Types of FE Model used for Study	Material	Property	Force	
CQUAD4 Elements			F = 0.5 Newton	
CHEXA Elements	E = 2.1E5	Thislesson 0.4 mars		
TIE (N2S) contacts with CHEXA & CQUAD	Nu = 0.3	i nickness = 0.1 mm		
RSSCON Model with CHEXA & CQUAD				

COMPARISON STUDY OF RSSCON WITH CANTILEVER MODEL

Results Summary	Displacements at tip (in mm)	Maximum Stresses at the Clamped End (in MPA)			
CQUAD4	0.3487	2356			
CHEXA	0.3475	2472			
TIE-N2S (CHEXA-CQUAD)	0.3469	2386			
RSSCON	0.3479	2423			



File Name and Location

...\STUDENT-EXERCISE\7a_Beam_Rib\rib.hm

Objectives

This exercise runs a linear static analysis on a simple C beam modeled with shell elements. Additional ribs will be added and connected to the beam using freeze contact.



The objective of this project is to determine without any mesh changes if the additional ribs will reduce the maximum total displacement to below 0.38.

- 1. Open the model in HyperMesh Desktop
- 2. Review the model (control cards, components, properties, materials, sets, load collectors & step)
- 3. Run the static analysis in OptiStruct, review the results in HyperView and check maximum static displacement
- 4. Create a group collector freeze_contact (card image CONTACT) with TYPE = FREEZE, SSID = slaves (grid) set (ID 1) and MSID master (element) set (ID 2)
- 5. Rerun the analysis with OptiStruct, review the results in HyperView and check if maximum static displacement is below 0.38

Hints (1/3)

2. To review the model wrt components, properties and materials the component view in the model browser is well suited.

Common control cards requests are set: SCREEN and OUTPUT

There is one static load step defined: analysis

There are two sets defined: slaves as grid set (ID 1) master as element set (ID 2)





Hints (2/3)

- Max. displacement = 0.4089 (deformed shape inflated by 100) The two ribs are not connect to the beam.
- 4. Use HyperMesh's Quick Access Tool (Crtl+f) to create a CONTACT card.



CLEARANCE DISCRET



Hints (3/3)

5. Max. displacement = 0.3676 < 0.38 (deformed shape inflated by 100)

The two ribs are connect to the beam.





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INTRODUCTION TO PARALLELIZATION



INTRODUCTION PARALLELIZATION

High Performance Computing

- Leverages computing resources standalone or cluster
- Message Passing Interfaces
- Advanced Memory handling capabilities
- Large matrix factorizations, inversions, and manipulations across multiple degree-of-freedom systems

Computer Architecture

- Node Computing machine with single or multiple sockets.
- Socket Each socket contains one processor.
- Processor Typically contains multiple cores/CPU's where computations are performed.
- Core/CPU Computations are performed here.
- Thread a single core, may be able to handle multiple parallel computations (via threads).

INTRODUCTION PARALLELIZATION

Cluster

- A computational cluster is a collection of nodes that are connected together to perform as a single unit.
- The tasks assigned to a cluster can be internally distributed and reconfigured by various software to nodes within the cluster.





INTRODUCTION PARALLELIZATION

Node

- A node is a computing machine/workstation/laptop within a cluster.
- It consists of different electrical and electronic components, such as Central Processing Units/Cores, memory, and ports that communicate with each other through complex systems and electronic pathways.
- Typically, a node consists of one or more sockets, which further contain one Physical Processor each.



SERIAL VERSUS PARALLEL COMPUTING

Serial Computing	Parallel Computing
Solution is divided into discrete instructions.	Solution is divided into sections, which are in-
	turn aivided into discrete instructions.
Sequential Execution of discrete instructions one logical processor.	Parallel Execution of discrete instructions of all sections simultaneously on multiple logical processors.
At each point in the time-domain, only a single discrete instruction is executed.	At each point in the time-domain, multiple discrete instructions relating to multiple parts are executed simultaneously.
Runtimes are typically high compared to Parallel Computing.	Runtimes are typically lower than Serial Computing.

OPTISTRUCT PARALLELIZATION – SMP

Shared Memory Parallelization (SMP)

• Shared Memory Parallelization in OptiStruct does not require different executables or the installation of separate components for message passing.



OPTISTRUCT PARALLELIZATION – DMP

Distributed Memory Parallelization (DMP)

- Parallelization technique in computing that is employed to achieve faster results by splitting the program into multiple subsets and running them simultaneously on multiple processors/machines.
- Memory is distributed across multiple processors or nodes.





OPTISTRUCT PARALLELIZATION – DMP TYPES

Distributed Memory Parallelization (DMP) Types

- Load Decomposition Method (LDM)
 - Large granularity
 - Efficient when there are a large number of loads/Boundary Conditions.
 - Ratio of loads/Boundary Conditions number to the number of nodes should be high.
- Not efficient for extremely large models
- Domain Decomposition Method (DDM)
 - Lower granularity
 - Efficient for extremely large models in a cluster.
- Multi-Model Optimization (MMO)
- Failsafe Topology Optimization (FSO)

OPTISTRUCT PARALLELIZATION – SPMD

Hybrid Parallelization – SPMD - Single Program Multiple Data (SMP + DMP)

- Combination of SMP and DMP
- Individual MPI process can be run in SMP configuration.
- Can generate enhanced runtime reduction when compared to either just SMP or DMP runs, individually.



OPTISTRUCT PARALLELIZATION – BEST PRACTICES DDM

OptiStuct run best in hybrid mode against pure MPI or pure SMP modes

- Always apply full nodes
- # of domain per node: 4
- # of threads per domain: (# of cores) / (# of domain per node)
 - E.g. on Ivy bridge E5-2697, total number of cores is 24, so # of threads per domain is 24/4=6

Proper number of nodes

- DDM needs to run in cluster to reduce memory requirement per host.
- Memory reduction for each domain is not linear
- The least number might be that fits for in-core mode.
- Do a check run first to get the memory estimation

OPTISTRUCT PARALLELIZATION – BEST PRACTICES DDM

Don't share nodes with other jobs.

- May cause serious load unbalancing problem.
- Each DDM job occupies the whole node.

Place all threads in one socket, e.g. on NUMA node, w/ dual socket, 12 cores, 24 cores total

- 6 MPI, 4 threads per MPI \rightarrow okay when memory sufficient
- 4 MPI, 6 threads per MPI \rightarrow recommended
- * 3 MPI, 8 threads per MPI \rightarrow load unbalancing
- * 2 MPI, 12 threads per MPI \rightarrow use when necessary

Local fast disk is crucial to OptiStruct performance. It should be at least used for scratch directory, through -scr or -tmpdir option.

For large model with big amount of output request, we suggest to put fem file also on local disk and run OptiStruct there.

QUESTIONS & ANSWERS

1. What do SMP and DMP stand for?





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RUN OPTIONS



RUN OPTIONS FOR OPTISTRUCT

Selected Run Options for OptiStruct (see <u>OptiStruct User's Guide</u> for more)

- -analysis Submit an analysis run. This option will also check the optimization data; the job will be terminated if any errors exist.
- -optskip Submit an analysis run without performing check on optimization data (skip reading all optimization related cards).
- -check Submit a check job through the command line.
- -nt x Number of threads/cores (x) to be used for SMP solution.
- -np X Number of processors (X) to be used for SPMD analysis.
- -len X Preferred upper bound on dynamic memory allocation (with X in RAM MBytes)
- -maxlen X Hard limit on the upper bound of dynamic memory allocation (with X in RAM MBytes). OptiStruct will not exceed this limit.
- -core X The solver assigns the appropriate memory required. If there is not enough memory available, OptiStruct will error out. (in incore solution is forced, out out-of-core solution, min minimum core solution)
- -out Echos the output file to the screen.

RUN OPTIONS FOR OPTISTRUCT – HW SOLVER RUN MANAGER

For a complete list of available options including plausibility checks use Options from the HyperWorks Solver Run Manager

HyperWorks Solver Run Manager (@DEWLT257)								
File Edit View	Logs Solver HyperWorks	Help						
Input file(s):	OilPlanCover_Opti.fem		ß					
Options:	-ncpu 4 -core in							
🔲 Use SMP: -nt	2 Use MPI options	Use solver control	Schedule delay					
		Run	Close					

Available Options							
Select the options to use for the solver run:							
Indicates available amount for memory -fixlen Specifies exact amount of memory for t -maxlen Maximum all -wolen Below that Select value for argument to "-core" V -core	(MB) the solver y ti =						
□ -i64 Use exect □ -i64slv Force BC: OUT	r, mo						
MIN -rsf Ram safety factor <1.0>, default 1.0 -check Check run only -analysis Analysis run only -analysis containe and action only and action on the safety factor of the s							
Image: Second	ast unsuc sity<1.0 ching mate						
-checkel Element quality checks -xml Specify that the input is an XML fit -acf Specify that the input is an ACF fit -radopt Specify that the input is an optimit -tmpdir Request specific scratch directory, mathematical specify disk i/o mode for sparse solve -ramdisk Request in-core storage for some interval	lle for mu lle for mu ization in ay be repe rr: basic, rnal data						
Image: Constraint of the screen Echo the output file to the screen Image: Constraint of the screen Image: Constraint of the screen Apply Options Append Options	• Close						

RUNNING ONE ITERATION ONLY

There are many cases where the user wants to run only one iteration

- to check the analysis results for the initial design
- to output sensitivity information for the initial design
- to output DREPORT information for the initial design

• etc.

```
Use doptprm, desmax, 0
```

This will run a regular optimization but stops after the first iteration, i.e. the structural response depends on value of the design variables

If an analysis run is desired instead, use run options -analysis or -optskip

This will run an analysis with all optimization cards skipped, i.e. the structural response depends on FE data and not the design variables.

Entities	ID 💊	Include	•
🖨 🚋 Optimization Controls (1)			
me optistruct_opticontrol	1	0	
🖶 👺 Optimization Responses (4)			
🗄 🔛 Properties (2)			
<u>.</u>			
Name			Value
Solver Keyword			DOPTPRM DESMAX
Name			optistruct_opticontrol
ID			1
Include			[Master Model]
Config			DOPTPRM
Maximum Design Iteration			0
Minimum Dimension			
Initial Material Fraction			
Minimum Element Material Densit	у		
Discreteness Parameter			
Checker Roard Control Option			

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OUTPUT MANAGEMENT



DEFAULT OUTPUT FILES

Protocol Files

- .out file \rightarrow provides a commentary on the solution process
- .stat file \rightarrow provides details on CPU and elapsed time for each solver module

Result Files

- . h3d file \rightarrow compressed binary file, containing both model and result data
- .res file \rightarrow is a HyperMesh binary results file
- .mvw file \rightarrow HyperView/HyperGraph session file to open results in HyperWorks Desktop
- .pch & .op2 file \rightarrow Nastran Punch format and Output2 format

html Files

- .html file \rightarrow contains a problem summary and results summary of the run.
- frames.html \rightarrow opens the .h3d files using the HyperView Player browser plug-in
- menu.html → facilitates the selection of the appropriate .h3d file, for the HyperView Player browser plug-in

COMMON CONTROL CARDS



 \bigtriangleup

RECOMMENDATIONS

OUTPUT controls the format of default results output

Use result keywords like DISPLACEMENT/STRESS for detailed control

- Global or subcase dependency
- Additional output-Formats like .pch file
- Output only for a subset of nodes/elements/properties
- More detailed output specific control like stress type or stress location

Usage of other output control commands like FORMAT or PARAM, POST is possible, but not necessary/recommended as OUTPUT is more flexible.

Output data overview in OptiStruct help



EXAMPLE: ANALYSIS

Outputs

- Disable .res file (use .h3d instead) and .html files
- Enable .op2 file including model data
- Reduce stress output to von Mises
- · Displacements of node sets to ascii files
 - .pch file for load case brake (node set 1)
 - .disp (opti) file for load case pothole (node set 2)

In HyperMesh via

- Entity Editor (with HyperMesh's Quick Access Tool (Crtl+f))
- Load Step Browser
- Control Cards

\$\$ optistruct
ş
OUTPUT, H3D, FL
OUTPUT, OP2, FL, MODEL
OUTPUT, HTML, , NO
STRESS(VON) = ALL
\$\$
\$\$ Case Co
\$\$
Ş
SUBCASE 1
LABEL brake
SPC = 1
LOAD = 2
DISPLACEMENT (PCH) = 1
Ş
SUBCASE 2
LABEL corner
SPC = 1
LOAD = 3
DISPLACEMENT (OPTI) = 2
ş
SUBCASE 3
LABEL pothole
SPC = 1
LOAD = 4

EXAMPLE: ANALYSIS

Entities	ID 💊	Include 🔄	Entities		ID 💊 Include	A	Entities	ID 😵 Inc	ude \land	Entities	ID 😯 Incl	lude í
🕀 💫 Assembly Hierarchy			🕀 💫 Assembly Hierarch	,			🗄 🗟 Components (2)			🗄 🛜 Components (2)		
🖨 🐻 Cards (2)		:	🗇 🐻 Cards (2)			E	🖶 🙀 Design Variables (1)			🕀 🙀 Design Variables (1)		1
GLOBAL_OUTPUT_REQUEST	1	0	GLOBAL_OU	FPUT_REQUEST	1 0		🕀 🖳 Load Collectors (4)		=	🕀 🙀 Load Collectors (4)		
OUTPUT	2	0	COUTPUT		2 0		🖨 🙀 Load Steps (3)			🖃 诸 Load Steps (3)		
🕀 🛜 Components (2)			E Components (2)				🛶 brake	1	0	🚽 🏚 brake	1	0
🖶 🙀 Design Variables (1)			🕀 🙀 Design Variables (*)			- 📥 corner	2	0	- 📥 corner	2	0
🗄 🙀 Load Collectors (4)			🕀 👯 Load Collectors (4)				- 📥 pothole	3	0	📥 pothole	3	0
		+				*	1 m		-	1 🗠		
Name	Value		Name	Value			Name	Value	-	Name	Value	1
STRAIN			Include	[Master Model]			DAMAGE			DAMAGE		_
STRESS			Status				DISPLACEMENT			DISPLACEMENT		
STRESS_NUM =	1		number_of_outputs =	3			DISPLACEMENTS_NUM =	1		DISPLACEMENTS_NUM =	1	
GLOBAL_OUTPUT_REQUES	FT 1		OUTPUT 1				□ 1			□ 1		
SORTING			KEYWORD	H3D			SORTING			SORTING		
FORMAT			FREQ	FL			FORMAT			FORMAT	OPTI	
FORM			OPTION				FORM			FORM		
TYPE	VON		🗉 OUTPUT 2				ROTATIONS			ROTATIONS		
LOCATION			KEYWORD	0P2			RANDOM			RANDOM		
RANDOM			FREQ	FL			PEAK			PEAK		
PEAK			OPTION	MODEL			MODAL			MODAL		_
MODAL			E OUTPUT 3				FOURIER			FOURIER		
SURF			KEYWORD	HTML			ANALYSIS		-	ANALYSIS		
NEUBER			OPTION	NO			TYPE		=	TYPE		
MNF			1				OPTION	SID		OPTION	SID	
THRESH							SID	(1) node_	set_1	SID	(2) node_:	_set_2
RTHRESH							DRESPONSE			DRESPONSE		L
TOP							EDE			EDE		
RTOP							EKE			EKE		
OPTION	ALL					_	ELFORCE			ELFORCE		
	1000					_	- FRR	[more]			(mm)	_



ş					
SUE	SCASE		1		
I	ABEL	brake			
5	SPC =		1		
I	OAD =	-	2		
Ι	DISPLA	ACEMENT	(PCH)	=	1
~					

LABEL corner SPC = 1 LOAD = 3 DISPLACEMENT (OPTI) = 2

KPI (Key Performance Indicator)

- OUTPUT,KPI or DISP(KPI) → .kpi file
- Currently supported for linear and nonlinear static analysis
- Max value for displacement/stress/strain/plastic strain based on groups by property
- · Stresses and strains are supported for shells and solids

<pre>\$ITERATION =</pre>	0							
\$DISPLACEMENTS								
\$SUBCASE ID =		2						
PID	GID	MAG	GID	Х	GID	Y	GID	Z
2	1114	5.31911E+00	1115	5.18782E+00	1114	1.80974E+00	1114	-2.92242E-02
<pre>\$ITERATION =</pre>	0							
\$ELEMENT STRESS	ES							
\$SUBCASE ID =		2						
PID	EID	VON	XX/XX_1	YY/XX_2	ZZ/YY_1	XY/YY_2	YZ/XY_1	XZ/XY_2
2	8621	1.11191E+02	7.32064E+00	1.03493E+02	2.21324E-01	-2.81675E+01	5.57553E-01	-2.31563E-01
<pre>\$ITERATION =</pre>	41							
\$DISPLACEMENTS								
\$SUBCASE ID =		2						
PID	GID	MAG	GID	Х	GID	Y	GID	Z
2	1114	8.12851E+01	1115	8.00305E+01	1114	2.70630E+01	9705	2.43199E-01
<pre>\$ITERATION =</pre>	41							
\$ELEMENT STRESS	ES							
\$SUBCASE ID =		2						
PID	EID	VON	XX/XX_1	YY/XX_2	ZZ/YY_1	XY/YY_2	YZ/XY_1	XZ/XY_2
2	8621	4.46134E+02	8.43841E+00	3.99810E+02	-1.60386E+01	-1.08307E+02	4.88293E+00	-1.18679E+01

Strain output from Normal Mode Analysis

- H3D
- Centroid and Corner



Energy output per component (PROP, COMP, SET, OPROP, OCOMP, OSET)

• Component based energy output means the sum of elemental energy for each component



Output with all different eigenvector normalization types (MAX, MAXT and MASS) is available with "ALL" in NORM field on EIGRA/EIGRL

- .out file has Generalized stiffness/mass output for MAX,MAT and MASS
- H3d file has eigenvector output for MAX,MAT and MASS

MASS				Generalized	Generalized
Subcase	Mode	Frequency	Eigenvalue	Stiffness	Mass
2	1	2.354957E+00	2.189404E+02	2.189404E+02	1.000000E+00
2	2	1.474904E+01	8.587906E+03	8.587906E+03	1.000000E+00
2	3	2.325721E+01	2.135379E+04	2.135379E+04	1.000000E+00
2	4	4.130079E+01	6.734052E+04	6.734052E+04	1.000000E+00
2	5	4.439779E+01	7.781842E+04	7.781842E+04	1.000000E+00
2	6	8.097436E+01	2.588539E+05	2.588539E+05	1.000000E+00
MAXT				Generalized	Generalized
Subcase	Mode	Frequency	Eigenvalue	Stiffness	Mass
2	1	2.354957E+00	2.189404E+02	5.458703E-01	2.493237E-03
2	2	1.474904E+01	8.587906E+03	2.142867E+01	2.495214E-03
2	3	2.325721E+01	2.135379E+04	5.385254E+01	2.521919E-03
2	4	4.130079E+01	6.734052E+04	1.679573E+02	2.494149E-03
2	5	4.439779E+01	7.781842E+04	1.288238E+02	1.655442E-03
2	6	8.097436E+01	2.588539E+05	6.442915E+02	2.489016E-03
MAX				Generalized	Generalized
Subcase	Mode	Frequency	Eigenvalue	Stiffness	Mass
2	1	2.354957E+00	2.189404E+02	5.458703E-01	2.493237E-03
2	2	1.474904E+01	8.587906E+03	2.142867E+01	2.495214E-03
2	3	2.325721E+01	2.135379E+04	5.385254E+01	2.521919E-03
2	4	4.130079E+01	6.734052E+04	1.679573E+02	2.494149E-03
2	5	4.439779E+01	7.781842E+04	1.288238E+02	1.655442E-03
2	6	8.097436E+01	2.588539E+05	6.442915E+02	2.489016E-03



OUTPUT AND DIAGNOSTICS

TIE and FREEZE diagnostics

• <filename>_nontied.fem for grids outside search distance

Initial Contact condition output (.cpr)

- CONTPRM, PREPRT, YES to request this output
- Breakdown for each CONTACT
- Check run only required

"vne				*******	******			
*****	Name	Content			************	*****		
(T)	CONTELD	Contact into	nface TD					
	SIVCID	Core slave d	rid ID of the	gan				
(1) (T)	NCMSTC	Number of co	prid ID of the	; yap ar gride of	the gap			
(±) (T)	NCSLVG	Number of co	nnected slave	aride bee	ide the core sl	21/0		
(±)	NCDIVO	arid of the	gap (only for	S2S conta	ct)	440		
(C)	STATUS	Gap status (OPEN/CLOSED/E	ROZEN)	,			
(R)	OPENING	Gap opening	(negative val	ue means p	enetration)			
(R)	RAWGAP	Raw gap open	ing based on	mesh coord	inates			
		(adjusted me	sh coordinate	s with N2S	ADJUST)			
(R)	PADDING	Gap padding	due to GPAD,	S2S ADJUST	, CLEARANCE, et	c.		
(R)	SAREA	Nodal contac	t area on the	e core slav	e grid			
		(only for S2	S contact)					
****	********							
		**********	************	********	*****	*****		
(I):	Integer nu	mber	*****	********	******	*****		
(I): (R):	Integer nu Real numbe	mber er		********	*****	*****		
I): R): C):	Integer nu Real numbe Characters	mber er		********	*****	*****		
I): R): C): ****	Integer nu Real numbe Characters	mber er s ***********	*****	**********	*******************	*****		
(I): (R): (C):	Integer nu Real numbe Characters	umber er s ************	*****	*********	***************	*****		
(I): (R): (C): *****	Integer nu Real numbe Characters	umber er *********************************		**************************************	*****	*****		
(I): (R): (C): *****	Integer nu Real numbe Characters	ace (S2S):	1 "cc 2 "sl	**************************************	*****	*****		
I): R): C): ****	Integer nu Real numbe Characters ************************************	ace (S2S): SURF/SET: SURF/SET:	1 "cc 2 "s1 1 "ma	**************************************	****	*****		
I): R): C): **** onta	Integer nu Real numbe Characters ************************************	umber sr ace (S2S): SURF/SET: SURF/SET:	1 "cc 2 "sl 1 "ma	**************************************	******	*****		
I): R): C): **** onta 	Integer nu Real numbe Characters Act Interfa Slave Master TID SL	mber er ace (S2S): SURF/SET: SURF/SET: 	1 "cc 2 "sl 1 "ma 5 NCSLVG	x*************************************	OPENING	****** ****** RAWGAP	PADDING	SAREA
I): R): C): ***** Conta	Integer nu Real numbe Characters ************************************	ace (S2S): SURF/SET: SURF/SET: JGID NCMSTG 302	1 "cc 2 "sl 1 "ma NCSLVG 6 5	ontact" .ave" !ster" 	OPENING 0.44950E+01	****** ****** RAWGAP 0.50000E+01	PADDING 0.50500E+00	SAREA 0.50000E+00
(I): (R): (C): ***** Conta	Integer nu Real numbe Characters states Slave Master ITID SLV	mber pr s sur sur r/SET: sur r/SET: sur r/SET: sur sur sur sur sur sur sur sur	1 "cc 2 "s] 1 "ma 5 NCSLVG 6 5 6 5	ortact" .ave" .ster" STATUS OPEN OPEN	OPENING 0.44950E+01 0.44950E+01	RAWGAP 0.50000E+01 0.50000E+01	PADDING 0.50500E+00 0.50500E+00	SAREA 0.50000E+00 0.50000E+00

OUTPUT AND DIAGNOSTICS



Contact with CLEARANCE = 0.0

Contact Int SI Mag	terface (S lave SURF/ ster SURF/	2S): SET: SET:	2 "sl 3 "s: 4 "ma	hell_cont lave" aster"	act"			
CONTID	SLVGID	NCMSTG	NCSLVG	STATUS	OPENING	RAWGAP	PADDING	SAREA
2	2081	16	8	OPEN	0.50000E+00	0.55000E+01	0.50000E+01	0.51840E+02
2	2082	12	8	OPEN	0.50000E+00	0.55000E+01	0.50000E+01	0.51840E+02
2	2083	9	8	OPEN	0.50000E+00	0.55000E+01	0.50000E+01	0.51840E+02
2	2084	12	8	OPEN	0.50000E+00	0.55000E+01	0.50000E+01	0.51840E+02
2	2112	9	8	OPEN	0.50000E+00	0.55000E+01	0.50000E+01	0.51840E+02
2	2113	12	8	OPEN	0.50000E+00	0.55000E+01	0.50000E+01	0.51840E+02
2	2133	12	8	OPEN	0.50000E+00	0.55000E+01	0.50000E+01	0.51840E+02
2	2134	9	8	OPEN	0.50000E+00	0.55000E+01	0.50000E+01	0.51840E+02
2	2151	12	0	OPEN	0.50000E+00	0.55000E+01	0.50000E+01	0.51840E+02
2	2100	12	8	OPEN	0.50000E+00	0.55000E+01	0.50000E+01	0.51840E+02
2	2184	9	8	OPEN	0.50000E+00	0.55000E+01	0.50000E+01	0.51840E+02
2	2204	12	5	OPEN	0 49999E+00	0 55000E+01	0 50000E+01	0 25920E+02
2	2205	9	5	OPEN	0.50000E+00	0.55000E+01	0.50000E+01	0.25920E+02
2	2206	9	8	OPEN	0.50000E+00	0.55000E+01	0.50000E+01	0.51840E+0
ontact Inte Sla	erface (S2 ave SURF/S	S): ET:	2 "she 3 "sla 4 "maa	ell_contac ave"	st"			
ontact Inte Sla Mas	erface (S2 ave SURF/S ter SURF/S	S): ET: ET:	2 "she 3 "sla 4 "mas	ell_contac ave" ster"	st"			
Contact Inte Sli Mas CONTID	erface (S2 ave SURF/S ter SURF/S SLVGID	S): ET: ET: NCMSTG	2 "she 3 "sla 4 "mas NCSLVG	ell_contac ave" ster" STATUS ========	st"	RAWGAP	PADDING	SAREA
Contact Int Sli Mas CONTID ====================================	erface (S2 ave SURF/S ter SURF/S SLVGID ====================================	S): ET: ET: NCMSTG ====================================	2 "she 3 "sla 4 "mas NCSLVG 8	ell_contac ave" ster" STATUS CLOSED	st"	RAWGAP 0.55000E+01	PADDING 0.55000E+01	SAREA
Contact Int Sli Mas CONTID 2 2	erface (S2 ave SURF/S ter SURF/S 	S): ET: ET: NCMSTG 16 12	2 "she 3 "sla 4 "mas NCSLVG 8 8	ell_contac we" ster" STATUS CLOSED CLOSED	st"	RAWGAP 0.55000E+01 0.55000E+01	PADDING 0.55000E+01 0.55000E+01	SAREA 0.51840E+02 0.51840E+02
Contact Int Sli Mas CONTID 2 2 2 2	erface (S2 ave SURF/S ter SURF/S SLVGID 2081 2082 2083	S): ET: ET: NCMSTG 16 12 9	2 "she 3 "sla 4 "mas NCSLVG 8 8 8	ell_contac ive" ster" STATUS CLOSED CLOSED CLOSED	ct"	RAWGAP 0.55000E+01 0.55000E+01 0.55000E+01	PADDING 0.55000E+01 0.55000E+01	SAREA 0.51840E+02 0.51840E+02 0.51840E+02 0.51840E+02
CONTID 2 2 2 2 2 2 2	erface (S2 ave SURF/S ter SURF/S SLVGID 2081 2082 2083 2084	S): ET: ET: NCMSTG 	2 "she 3 "sla 4 "mas NCSLVG 	ell_contac ve" ster" STATUS CLOSED CLOSED CLOSED CLOSED	ct"	RAWGAP 0.55000E+01 0.55000E+01 0.55000E+01 0.55000E+01	PADDING 0.55000E+01 0.55000E+01 0.55000E+01 0.55000E+01	SAREA 0.51840E+02 0.51840E+02 0.51840E+02 0.51840E+02
CONTID 2 2 2 2 2 2 2 2 2 2 2	erface (S2 ave SURF/S ter SURF/S SLVGID 2081 2082 2083 2084 2112	S): ET: ET: NCMSTG 16 12 9 12 9	2 "she 3 "sla 4 "mas NCSLVG 8 8 8 8 8 8 8	ell_contac ve" ster" STATUS CLOSED CLOSED CLOSED CLOSED	st"	RAWGAP 0.55000E+01 0.55000E+01 0.55000E+01 0.55000E+01 0.55000E+01	PADDING 0.55000E+01 0.55000E+01 0.55000E+01 0.55000E+01 0.55000E+01	SAREA 0.51840E+02 0.51840E+02 0.51840E+02 0.51840E+02 0.51840E+02 0.51840E+02
CONTID 2 2 2 2 2 2 2 2 2 2 2 2 2	erface (S2 ave SURF/S ter SURF/S SLVGID 2081 2082 2083 2084 2112 2113	S): ET: ET: NCMSTG 	2 "she 3 "sla 4 "mas NCSLVG 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8	ell_contac ave" ster" STATUS CLOSED CLOSED CLOSED CLOSED CLOSED CLOSED	st"	RAWGAP 0.55000E+01 0.55000E+01 0.55000E+01 0.55000E+01 0.55000E+01	PADDING 0.55000E+01 0.55000E+01 0.55000E+01 0.55000E+01 0.55000E+01 0.55000E+01	SAREA 0.51840E+02 0.51840E+02 0.51840E+02 0.51840E+02 0.51840E+02 0.51840E+02
Contact Int Sl. Mas CONTID 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	erface (S2 ave SURF/S ter SURF/S SLVGID 2081 2082 2083 2084 2112 2113 2133	S): ET: ET: NCMSTG 	2 "she 3 "sla 4 "mas NCSLVG 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8	ell_contac we" ster" STATUS CLOSED CLOSED CLOSED CLOSED CLOSED CLOSED CLOSED CLOSED	ct"	RAWGAP 0.55000E+01 0.55000E+01 0.55000E+01 0.55000E+01 0.55000E+01 0.55000E+01	PADDING 0.55000E+01 0.55000E+01 0.55000E+01 0.55000E+01 0.55000E+01 0.55000E+01	SAREA 0.51840E+02 0.51840E+02 0.51840E+02 0.51840E+02 0.51840E+02 0.51840E+02 0.51840E+02
Contact Int Sl. Mass CONTID 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	erface (S2 ave SURF/S ter SURF/S SLVGID 2081 2082 2083 2084 2112 2113 2133 2134	S): ET: ET: NCMSTG 16 12 9 12 9 12 9 12 9	2 "she 3 "sla 4 "mas NCSLVG 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8	ell_contac we" ster" STATUS CLOSED CLOSED CLOSED CLOSED CLOSED CLOSED CLOSED CLOSED	st"	RAWGAP 0.55000E+01 0.55000E+01 0.55000E+01 0.55000E+01 0.55000E+01 0.55000E+01 0.55000E+01	PADDING 0.55000E+01 0.55000E+01 0.55000E+01 0.55000E+01 0.55000E+01 0.55000E+01 0.55000E+01	SAREA 0.51840E+02 0.51840E+02 0.51840E+02 0.51840E+02 0.51840E+02 0.51840E+02 0.51840E+02 0.51840E+02
Contact Int Sl. Mas CONTID 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	erface (S2 ave SURF/S ter SURF/S SLVGID 	S): ET: ET: NCMSTG 16 12 9 12 12 9 12 12 12 9 9 9	2 "she 3 "sla 4 "mas NCSLVG 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8	CLOSED CLOSED CLOSED CLOSED CLOSED CLOSED CLOSED CLOSED CLOSED CLOSED CLOSED	st"	RAWGAP 0.55000E+01 0.55000E+01 0.55000E+01 0.55000E+01 0.55000E+01 0.55000E+01 0.55000E+01 0.55000E+01	PADDING 0.55000E+01 0.55000E+01 0.55000E+01 0.55000E+01 0.55000E+01 0.55000E+01 0.55000E+01 0.55000E+01	SAREA 0.51840E+02 0.51840E+02 0.51840E+02 0.51840E+02 0.51840E+02 0.51840E+02 0.51840E+02 0.51840E+02 0.51840E+02
Contact Int Sl. Mas CONTID 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	erface (S2 ave SURF/S ter SURF/S SLVGID 2081 2082 2083 2084 2112 2113 2133 2134 2151 2166	S): ET: ET: NCMSTG 16 12 9 12 9 12 12 9 9 12	2 "she 3 "sla 4 "mas NCSLVG 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8	CLOSED CLOSED CLOSED CLOSED CLOSED CLOSED CLOSED CLOSED CLOSED CLOSED CLOSED CLOSED CLOSED	ct"	RAWGAP 0.55000E+01 0.55000E+01 0.55000E+01 0.55000E+01 0.55000E+01 0.55000E+01 0.55000E+01 0.55000E+01	PADDING 0.55000E+01 0.55000E+01 0.55000E+01 0.55000E+01 0.55000E+01 0.55000E+01 0.55000E+01 0.55000E+01 0.55000E+01	SAREA 0.51840E+02 0.51840E+02 0.51840E+02 0.51840E+02 0.51840E+02 0.51840E+02 0.51840E+02 0.51840E+02 0.51840E+02
ontact Int Sl. Mas CONTID 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	erface (S2 ave SURF/S ster SURF/S SLVGID 2082 2083 2084 2112 2113 2133 2134 2134 2151 2166 2167	s): ET: ET: NCMSTG 16 12 9 12 9 12 12 9 9 12 12 9 9 12 9 9 9	2 "she 3 "sla 4 "mas NCSLVG 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8	ell contactive" ster" status status closed	st"	RAWGAP 0.55000E+01 0.55000E+01 0.55000E+01 0.55000E+01 0.55000E+01 0.55000E+01 0.55000E+01 0.55000E+01 0.55000E+01	PADDING 0.55000E+01 0.55000E+01 0.55000E+01 0.55000E+01 0.55000E+01 0.55000E+01 0.55000E+01 0.55000E+01 0.55000E+01 0.55000E+01	SAREA 0.51840E+02 0.51840E+02 0.51840E+02 0.51840E+02 0.51840E+02 0.51840E+02 0.51840E+02 0.51840E+02 0.51840E+02 0.51840E+02 0.51840E+02
ontact Int. Sl. Mas CONTID 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	erface (S2 ave SURF/S ========= SLVGID ======= 2081 2082 2083 2084 2112 2113 2133 2134 2134 2151 2166 2167 2184	S): ET: ET: NCMSTG 16 12 9 12 12 9 12 12 9 9 12 12 9 9 9 12 2 9 9 9 9	2 "she 3 "sla 4 "mas NCSLVG 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8	Ell contactive" ster" STATUS STATUS CLOSED CLOSED CLOSED CLOSED CLOSED CLOSED CLOSED CLOSED CLOSED CLOSED CLOSED CLOSED CLOSED CLOSED	st"	RAWGAP 0.55000E+01 0.55000E+01 0.55000E+01 0.55000E+01 0.55000E+01 0.55000E+01 0.55000E+01 0.55000E+01 0.55000E+01	PADDING 0.55000E+01 0.55000E+01 0.55000E+01 0.55000E+01 0.55000E+01 0.55000E+01 0.55000E+01 0.55000E+01 0.55000E+01 0.55000E+01 0.55000E+01	SAREA 0.51840E+02 0.51840E+02 0.51840E+02 0.51840E+02 0.51840E+02 0.51840E+02 0.51840E+02 0.51840E+02 0.51840E+02 0.51840E+02 0.51840E+02
CONTID 2 2 2 2 2 2 2 2 2 2 2 2 2	erface (S2 ave SURF/S ter SURF/S SLVGID 2081 2084 2083 2084 2112 2113 2133 2134 2151 2156 2167 2164 2167 2184 2204	S): ET: ET: NCMSTG 16 12 9 12 9 12 12 9 12 12 9 9 12 12 9 12 9 12	2 "she 3 "sla 4 "mas NCSLVG 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8	CLOSED CLOSED CLOSED CLOSED CLOSED CLOSED CLOSED CLOSED CLOSED CLOSED CLOSED CLOSED CLOSED CLOSED CLOSED CLOSED	st"	RAWGAP 0.55000E+01 0.55000E+01 0.55000E+01 0.55000E+01 0.55000E+01 0.55000E+01 0.55000E+01 0.55000E+01 0.55000E+01 0.55000E+01	PADDING 0.55000E+01 0.55000E+01 0.55000E+01 0.55000E+01 0.55000E+01 0.55000E+01 0.55000E+01 0.55000E+01 0.55000E+01 0.55000E+01 0.55000E+01 0.55000E+01	SAREA 0.51840E+02 0.51840E+02 0.51840E+02 0.51840E+02 0.51840E+02 0.51840E+02 0.51840E+02 0.51840E+02 0.51840E+02 0.51840E+02 0.51840E+02 0.51840E+02 0.51840E+02 0.51840E+02
CONTID 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	erface (S2 ave SURF/S ster SURF/S SLVGID 2082 2083 2084 2112 2113 2133 2134 2151 2166 2167 2184 2204 2205	S): ET: ET: NCMSTG 16 12 9 12 9 12 12 9 9 12 12 9 9 12 2 9 9 12 9 9 12 9 9 9	2 "she 3 "sla 4 "mas NCSLVG 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8	Ell contactive" ster" STATUS CLOSED	st"	RAWGAP 0.55000E+01 0.55000E+01 0.55000E+01 0.55000E+01 0.55000E+01 0.55000E+01 0.55000E+01 0.55000E+01 0.55000E+01 0.55000E+01 0.55000E+01 0.55000E+01	PADDING 0.55000E+01 0.55000E+01 0.55000E+01 0.55000E+01 0.55000E+01 0.55000E+01 0.55000E+01 0.55000E+01 0.55000E+01 0.55000E+01 0.55000E+01 0.55000E+01 0.55000E+01 0.55000E+01	SAREA 0.51840E+02 0.51840E+02 0.51840E+02 0.51840E+02 0.51840E+02 0.51840E+02 0.51840E+02 0.51840E+02 0.51840E+02 0.51840E+02 0.51840E+02 0.51840E+02 0.51940E+02 0.51920E+02



HDF5

- Linear Static, Normal mode and buckling
 - DISP
 - STRESS/STRAIN (CORNER)
 - CSTRESS/CSTRAIN
 - FORCE
 - OLOAD
 - SPCF
 - GPF

Recent Files E:W2018/OS_HDF5/opt_hdf	j_quad4_V13.hdf5																				👻 CI
os_hdf5_2D3D_debugtb_v15_float.h	HEXA20 at	OntiStruct/R	ESULT/Sub	rase 9/STRES	V los bd#5 2	D3D debug	th v15 float	thdf5 in EW201	SOS HDE	QUAD8 at	/OptiStruct/Ri	ESULT/Sul	case 9/STRESS	/ (os_hdf5_2D	3D_debug_t	_v15_float.hdf5	in E:W20	18/05_HDF5]			
→ ⊕ OptiStruct → ⊕ RESULT → ⊕ Subcase 9	Iable M									Iable 🔟]										
• 🖶 STRAIN		Flamont ID	~~	w	77	vv	¥7	77			ElementID	FD1	Z1_XX	Z1_YY	Z1_XY	FD2	Z2_XX	Z2_YY	Z2_XY		
HEXA20	0 1	12	271 21155	2 5850596	2 5850596	AT 15526082	3 1211204	2.8852085		0	11	-0.33	38.083176	38.083176 -	5.4698550	33 -67	32277 -	67.32277 9.	785276E		
- M QUADB	1 1	33	275.83734	0.1118853	0.1118853	1.6251471	1.6066574	7.3482225		1	12	-0.33	261.72604	-5.299364	2.7583322 0	33 275	2209 -	-1.9256552 -1	8267451		
🛉 📹 STRESS	2 1	44 3	274.46988	0.09784404	0.09784404	1.1466665	-6.4004323.	-2.63898E		2	13	-0.33	261.72604	-5.299354	3.038524E 0	33 275	2209 -	-1.9256552 4.	3160056		
- HEXA20	3 1	55 3	274.7973	-0.0033898	-0.0033898	1.4880112	-2.0624197	-1.3741681		3	14	-0.33	261.72604	-5.299364	2.92659360	33 275	2209 -	1.9256552 7.	651147E		
QUAD8	4 1	56 3	274.70438	-0.0046126	-0.0046126	2.1728698	1.1965396	-8.7581353		- 4	10	-0.33	201.72004	2 8023088	1.480128E 0	33 275	97205	3 7604344 1	20174E		
opt_hdl5_quad4_V13.hdl5	5 1	77	274.74384	0.03212796	0.03212796	7.682139	-6.016062	-6.805857		6	17	-0.33	274 13953	2 8023088	7 2226415 0	33 277	97205	3 7604344 1	0575215		
- 📹 OptiStruct	7 1	58 5	275.30944	1.0963160	1 9963169	2.5928738	-1.0009448. 9.6657044	1.667469E		7	18	-0.33	274.13953	2.8023088	4.396614 0	33 277	97205	3.7604344 -3	089463		
RESULT	8 2	10	277.0468	10.037225	10.037225	-8 174207	17470055	-3 7039057		8	19	-0.33	274.13953	2.8023088 -	2.08733230	33 277	.97205	3.7604344 -7	0990934		
a 🚝 Iteration 0	9 4	01	291,22885	1.7908928	1.7908928	5.5091023	1.4897191	-6.493016		9	20	-0.33	274.44562	-0.36085033 2	2.340864E 0	33 274	.16153 -	-0.43186817 1.	1089317		
Charles and a										10	21	-0.33	274.44562	-0.36085033	3.072064E 0	33 274	.16153 -	-0.43186817 1.	9572787		
Subcase I										11	22	-0.33	274,44552	0.36085033 -	1.50810550	33 274	16153 -	-0.43186817 -1	279024		
• • NODAL	L									16	23	0.33	274.44302	0.04074084	7.4604400 0	33 274	70400	0.43100017 -2	279031		
- III Displacement	TRIA3 at /	OptiStruct/RE	SULT/Iterati	on 0/Subcase	1/STRAIN/ (op	Lhdl5_quad4	_V13.hdf5 in	h E:W2018/OS_H	IDF5]		QUAD	4 at /Optic	truct/RESULT/Ite	ration 0/Subca	ise 1/STRESS	[opt_hdf5_qua	d4_V13.hd	15 in E:W2018)	OS_HDF5]		
e- 📹 STRAIN	Table hal										Table	hall.									
- 🙀 QUAD4											0										
- TRIA3												_									
- STRESS				71 XX	Z1 YY	Z1_XY	FD2	Z2_XX	Z2_YY	Z2_XY		Elem	ent ID FD1	Z1_XX	Z1_YY	Z1_XY	FD2	Z2_XX	Z2_YY	Z2_XY	
		ElementID	FD1				0.5	1.82156872	2.7170927	5.12615E-5	0	1	-0.5	0.0543027	710.97466	0.07890926	0.5	0.0543027.	-10.974663	0.07890926	
	0	Element ID 1125	-0.5	1.8215687	-2.7170927.	5.12615E-5	10.6					_									
STRESS GUAD4 Im RLA3 Iteration 2	0	Element ID 1125 1126	-0.5 -0.5	1.8215687. 4.441772E-5	-2.7170927.	5.12615E-5 -1.5970925.	0.0	4.441772E-5 4	.9007213	-1.5970925	1	2	-0.5	0.0509582	210.77244	0.1873145	0.5	0.0509582.	10.772447	0.1873145	
	0	Element ID 1125 1126 1127	-0.5 -0.5 -0.5	1.8215687 4.441772E-5 8.308804E-5 2.676226E-6	-2.7170927. 4.9007213. 6.6357126.	5.12615E-5 -1.5970925. -1.4732439.	0.5	4.441772E-5 4. 8.308804E-5 6.	9007213	-1.5970925 -1.4732439	1 2	2	-0.5	0.0509582	210.77244 25 -9.2435875	0.1873145	0.5	0.0509582	-10.772447 -9.2435875	0.1873145	
	0 1 2 3 4	Element ID 1125 1126 1127 1128 1129	-0.5 -0.5 -0.5 -0.5 -0.5	1.8215687. 4.441772E-5 8.308804E-5 3.676236E-5 -1.0015804	-2.7170927. 4.9007213. 6.6357126. -7.0772635. -7.953659.	5.12615E-5 -1.5970925. -1.4732439. -6.192201 6.811281E-5	0.5	4.441772E-6 4 8.308804E-5 6 3.676236E-5 -7 -1.0015804 -7	9007213 6357126 7.0772635 7.953659	-1.5970925 -1.4732439 -6.192201 6.811281E-5	1 2 3 4	2 3 4 5	-0.5 -0.5 -0.5	0.050958	210.772447 26 -9.2435875 8 -10.366495 5 -9.09506	0.1873145 0.22193845 0.2960636 0.5321336	0.5 0.5 0.5	0.0509582	-10.772447 -9.2435875 -10.366499 -9.09508	0.1873145 0.22193845 0.2960636 0.5321338	
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	0 1 2 3 4 5 6 7	Element ID 1125 1128 1127 1128 1129 1130 1131 1132	+D1 +0.5	1.8215687. 4.441772E-5 8.308804E-5 3.676236E-5 -1.0015804. 4.117556E-5 2.3004646. -2.2881599.	2.7170927. 4.9007213. 6.6357126. -7.0772635. -7.953659. 5.2249372. 1.2644051. 5.2566695.	5.12615E-5 -1.5970925 -1.4732439 -6.192201 6.811281E-5 -1.2389699 -1.0623285 -7.98767E-6	0.5 0.5 0.5 0.5 0.5 0.5	4.441772E-5 4. 8.308804E-5 6. 3.676236E-5 -7 -1.00158047 4.117556E-5 5. 2.30046461. -2.28815995	9007213 6357126 7.0772635 7.953659 2249372 2644051 2566695	-1.5970925 -1.4732439 -6.192201 6.811281E-5 -1.2389699 -1.0623285 -7.98767E-6	1 2 3 4 5 6 7	2 3 4 6 7 8	-0.5 -0.5 -0.5 -0.5 -0.5 -0.5 -0.5 -0.5	0.050958 0.2767022 0.0460138 0.2578686 0.6829114 0.0391828 0.2297175	210.77244 26 -9.243587 3 -10.36649 5 -9.09506 4 -7.863755 3 -9.768961 5 -8.784546	0.1873145 0.22193845 0.2960636 0.5321336 0.32656136 0.3966373 0.8215358	0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5	0.0509582 0.27670220 0.0460138 0.2578685 0.6829114 0.0391828 0.2297175	-10.772447 9.2435875 10.366499 9.09508 -7.8637557 -9.768961 -8.784546	0.1873145 0.22193845 0.2960636 0.5321336 0.32656136 0.3966373 0.8215358	
	0 1 2 3 4 5 6 8 7	Element ID 1125 1126 1127 1128 1129 1130 1131 1132	+D1 +0.5 +0.5 +0.5 +0.5 +0.5 +0.5 +0.5 +0.5	1.8215687. 4.441772E-5 8.308804E-5 3.676236E-5 -1.0015804. 4.117556E-5 2.3004646. -2.2881599.	2.7170927. 4.9007213. 6.6357126. -7.0772635. -7.953659. 5.2249372. 1.2644051. 5.2566695.	5.12615E-5 -1.5970925 -1.4732439 -6.192201 6.811281E-5 -1.2389699 -1.0623285 -7.98767E-6	0.5 0.5 0.5 0.5 0.5 0.5	4.441772E-5 4. 8.308804E-5 6. 3.676236E-5 -7 -1.00158047 4.117556E-5 5. 2.30046461 -2.28815995	9007213 6357126 7.0772635 7.953659 2249372 2644051 2566695	-1.5970925. -1.4732439. -6.192201 6.811281E-5 -1.2389699. -1.0623285. -7.98767E-6	1 2 3 4 5 6 7 8	2 3 4 5 6 7 8 9	-0.5 -0.5 -0.5 -0.5 -0.5 -0.5 -0.5 -0.5	0.050958 0.276702 0.0460138 0.2578685 0.6829114 0.0391828 0.2297175 0.6379612	210.77244 26 -9.243587 8 -10.366499 5 -9.09506 4 -7.863755 8 -9.768961 5 -8.784546 27 -7.745672	0.1873145 0.22193845 0.2960636 0.5321336 0.32656136 0.3966373 0.8215358 0.7953361	0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5	0.0509582. 0.27670226 0.0460138 0.2578685 0.6829114 0.0391828 0.2297175 0.63796122	-10.772447 9.2435875 -10.366499 -9.09506 -7.8637557 -9.768961 -8.784546 7.745672	0.1873145 0.22193845 0.2960636 0.5321336 0.32656136 0.3966373 0.8215358 0.7953361	
	0 1 2 3 4 5 6 7	Element ID 1125 1126 1127 1128 1129 1130 1131 1132	+D1 -0.5 -0.5 -0.5 -0.5 -0.5 -0.5 -0.5 -0.5	1.8215687. 4.441772E-5 8.308804E-5 3.676236E-5 -1.0015804. 4.117556E-5 2.3004646. -2.2881599.	2.7170927. 4.9007213. 6.6357126. -7.0772635. -7.953659. 5.2249372. 1.2644051. 5.2566695.	5.12615E-5 -1.5970925 -1.4732439 -6.192201 6.811281E-5 -1.2389699 -1.0623285 -7.98767E-6	0.5 0.5 0.5 0.5 0.5 0.5 0.5	4.441772E-6 4. 8.308804E-5 6. 3.676236E-5 -7 -1.0015804. 4.117556E-5 5. 2.30046461. -2.28815995	.9007213 .6357126 7.0772635 7.953659 .2249372 .2644051 .2566695	-1.5970925 -1.4732439 -6.192201 6.811281E-5 -1.2389699 -1.0623285 -7.98767E-6	1 2 3 4 5 6 7 8 9	2 3 4 5 6 7 8 9 10	-0.5 -0.5 -0.5 -0.5 -0.5 -0.5 -0.5 -0.5	0.050958 0.2767022 0.0460138 0.2578688 0.6829114 0.0391828 0.229717 0.6379612 1.236970	210.77244 26 -9.243587 3 -10.36649 5 -9.09506 4 -7.863755 3 -9.768961 5 -8.784546 27 -7.745672 5 -6.751690 9 -00000	0.1873145 0.22193845 0.2960636 0.5321336 0.32656136 0.3966373 0.8215358 0.7953361 0.040414333	0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5	0.0509582. 0.27670226 0.0460138 0.2578685 0.6829114 0.0391828 0.2297175 0.63796122 1.2369705	10.772447 -9.2435875 -10.366499 -9.09508 -7.8637557 -9.768961 -8.784546 7.745672 -6.7516904 -0.0000	0.1873145 0.22193845 0.2960638 0.5321338 0.32656136 0.3866373 0.8215358 0.7953381 0.4414333	
	0 1 2 3 4 5 6 7	Element ID 1125 1126 1127 1128 1129 1130 1131 1132	+D1 -0.5 -0.5 -0.5 -0.5 -0.5 -0.5 -0.5 -0.5	1.8215687 4.441772E-5 8.308804E-5 3.676236E-5 -1.0015804 4.117566E-5 2.3004646 -2.2881599	2.7170927. 4.9007213. 6.6357126. -7.0772635. -7.953659. 5.2249372. 1.2644051. 5.2566695.	5.12615E-5 -1.5970925 -1.4732439 -6.192201 6.811281E-5 -1.2389699 -1.0623285 -7.98767E-6	0.5 0.5 0.5 0.5 0.5 0.5	4.441772E-6 4. 8.308804E-5 6. 3.676236E-5 -7 -1.0015804. 4.117556E-5 5. 2.30046461. -2.28815995	.9007213 .6357126 7.0772635 7.953659 .2249372 .2644051 .2566695	-1.5970925 -1.4732439 -6.192201 6.811281E-5 -1.2389699 -1.0623285 -7.98767E-6	1 2 3 4 5 6 7 8 9 10	2 3 4 5 6 7 8 9 10 11 11	-0.5 -0.5 -0.5 -0.5 -0.5 -0.5 -0.5 -0.5	0.050953 0.2767022 0.0480133 0.2578885 0.6829114 0.0391825 0.2297175 0.6379612 1.2369705 0.0310115 0.0310115	210.77244; 259.243587; 310.36649; 59.09506 47.863755; 39.768961 58.784546 277.745672; 56.751690- 98.998069 8.998069 88.21845	0.1873145 0.22193845 0.2960636 0.5321336 0.32656136 0.3966373 0.8215358 0.7953361 0.40414333 0.48274052 1.0829626	0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5	0.0509582 0.27670220 0.0460138 0.257885 0.6829114 0.0391828 0.2297175 0.6379612 1.2369705 0.0310119 0.19235708	10.772447 9.2435875 -10.386499 -9.09508 -7.8637557 -9.768961 -8.784546 7.7.45672 -6.7516904 	0.1873145 0.22193845 0.2960638 0.5321336 0.32656136 0.3866573 0.8215358 0.7953361 0.40414333 0.40274052 1.0829626	
	0 1 2 3 4 4 5 6 6 7	Element ID 1125 1128 1127 1128 1129 1130 1131 1132	PD1 -0.5 -0.5 -0.5 -0.5 -0.5 -0.5 -0.5 -0.5	1.8215687 4.441772E-5 8.308804E-5 3.676236E-5 -1.0015804 4.117556E-5 2.3004646 -2.2881599	2.7170927. 4.9007213 6.6357126 -7.0772635. -7.953659. 5.2249372 1.2644051 5.2566695	5.12615E-5 -1.5970925. -1.4732439. -6.192201. -6.811281E-5 -1.2389699. -1.0623285. -7.98767E-6	0.5 0.5 0.5 0.5 0.5 0.5 0.5	4.441772E-64. 8.30804E-56. 3.676236E-5-7 4.1015804. 2.3004648. 1. -2.2881599. 5.	9007213 6357126 7.0772635 7.953659 2249372 2644051 2566695	-1.5970925 -1.4732439 -6.192201 6.811281E-5 -1.2389699 -1.0623285 -7.98767E-6	1 2 3 4 5 6 7 8 9 10 11 11	2 3 4 5 6 7 8 9 10 11 11 12 13	-0.5 -0.5 -0.5 -0.5 -0.5 -0.5 -0.5 -0.5	0.0509582 0.2767022 0.0460132 0.2578682 0.8829114 0.0391822 0.2297175 0.6379612 1.23697012 0.0310115 0.1923570 0.5691216	210.77244; 269.243587; 310.36649; 47.963755; 39.768961; 58.784546; 277.45672; 56.751690; 38.998089; 38.98089; 38.988089; 38.821845; 57.498879; 56.749879; 56.749879; 56.749879; 56.749879; 56.749879; 56.749879; 56.749857; 56.749857; 56.749857; 56.749857; 56.749857; 56.749857; 56.749857; 56.749857; 56.749857; 56.749; 56.	0.1873145 0.22193845 0.592193845 0.5321336 0.32656136 0.32656136 0.3966373 0.8215358 0.7953361 0.40414333 0.40414333 0.4024052 1.0829626	0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5	0.0509582. 0.27670226 0.0460138 0.2578685 0.6829114 0.0391828 0.2297175 0.63798121 1.2369705 0.0310119. 0.19235706 0.5691216	10.772447 5.9.2435875 -10.366499 -9.99508 -7.8637557 -9.768961 -8.784546 7.7.45872 -6.7516904 8.998089 -8.321845 -7.498879	0.1873145 0.22193845 0.2960636 0.5321336 0.32656136 0.3966373 0.8215358 0.7953361 0.40414333 0.48274052 1.0829626 1.2330383	
	0 1 2 3 4 4 5 6 6 7	Element ID 1125 1128 1127 1128 1129 1129 1130 1131 1132	PD1 -0.5 -0.5 -0.5 -0.5 -0.5 -0.5 -0.5 -0.5	1.8215687. 4.441772E-5 8.308904E-5 3.676236E-5 -1.0015804. 4.117556E-5 2.3004646. -2.2881599.	2.7170927. 4.9007213 6.6357126 -7.0772635. -7.953659. 5.2249372 1.2644051 5.2566695	5.12615E-5 -1.5970925. -1.4732439. -6.192201. -6.811281E-5 -1.2389699. -1.0623285. -7.98767E-6	0.5 0.5 0.5 0.5 0.5 0.5	4.441772E-54 8.30804E-56 3.676236E-57 4.117556E-5 2.30046461 -2.28815995	9007213 6357126 7.0772635. 7.953659 2249372 2644051 2566695	-1.5970925 -1.4732439 -6.192201 -6.811281E-5 -1.2389699 -1.0523285 -7.98767E-6	1 2 3 4 5 6 7 8 9 10 11 11 12 13	2 3 4 5 6 7 8 9 10 11 11 12 13 14	-0.5 -0.5 -0.5 -0.5 -0.5 -0.5 -0.5 -0.5	0.0509582 0.2767022 0.0460133 0.2578682 0.6829114 0.0391823 0.2297175 0.6379612 1.2369705 0.0310115 0.1923570 0.5691216 1.160456	210.77244; 26 -9.243587; 3 -10.366495 5 -9.09506 4 -7.963755; 3 -9.768961 5 -8.784546 27 -7.745672 5 -8.751690- 98.998089 08 -8.321845 5 -7.498879 -6.650005	0.1873145 0.22193845 0.2900838 0.5321338 0.32656136 0.3966373 0.8215358 0.7953361 0.40414333 0.48274052 1.0829626 1.2330383 1.0016379	0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5	0.0509582 0.27670226 0.0460138 0.2578685 0.6829114 0.0391828 0.2297175 0.83798121 1.2369705 0.0310119 0.19235706 0.5691216 1.160458	10.772447 5.9.2435875 -10.366499 -9.99508 -7.8637557 -9.768961 -8.784546 7.7.45872 -6.7516904 8.998089 -8.321845 -7.498879 -6.650005	0.1873145 0.22193845 0.2960636 0.5321336 0.32656136 0.3966573 0.8215358 0.7953361 0.40414333 0.48274052 1.0829626 1.2330383	
	0 1 2 3 4 5 6 6 7	Element ID 1125 1126 1127 1128 1129 1130 1131 1132	PD1 -0.5 -0.5 -0.5 -0.5 -0.5 -0.5 -0.5 -0.5	1.8215687. 4.441772E-5 8.30804E-5 3.676236E-5 -1.0015804. 4.117556E-5 2.3004646. -2.2881599.	2.7170927. 4.9007213. 6.6357126. 7.0772635. 7.953559. 5.2249372. 1.2644051. 5.2566695.	5.12615E-5 1.5970925. -1.4732439. -6.192201. 6.811281E-5 -1.2389699. -1.0623285. -7.98767E-6	0.5 0.5 0.5 0.5 0.5 0.5	4.441772E-54 8.308804E-56 3.678236E-5-7 -1.00158047 4.117586E-56 2.30046461 -2.28815995	9007213 6357126 7.0772635 7.953659 2249372 2844051 2566695	-1.5970925 -1.4732439 -6.192201 6.811281E-5 -1.2389699 -1.0623285 -7.98767E-6	1 2 3 4 5 6 7 8 9 10 11 112 13 14	2 3 4 5 6 7 8 9 10 11 12 13 14 15	-0.5 -0.5 -0.5 -0.5 -0.5 -0.5 -0.5 -0.5	0.050953; 0.2767022; 0.0460133; 0.2578685; 0.6829114; 0.0391822; 0.2297172; 0.6379612; 1.2369705; 0.0310115; 0.1923570; 0.5691211; 1.160456; 1.912172;	210.77244 269.243587 59.09506 47.963755 89.768961 58.784546 58.784546 58.784546 58.7745672 58.751690- 98.998089 188.321845 57.498879 -6.650005 15.8333401 -5.8333401	0.1873145 0.22193845 0.22193845 0.290638 0.32656136 0.396573 0.8215358 0.7953361 0.40414333 0.48274052 1.233383 1.46379 0.4612032	0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5	0.0509582 0.27670226 0.0460138 0.2578685 0.6829114 0.0391828 0.2297175 0.63798121 1.2369705 0.0310119 0.19235700 0.5691216 1.160458 1.9121721	10.772447 9.2435875 9.09506 -7.8637557 -9.768961 -8.784546 -7.745872 -6.7516904 -8.998089 88.321845 -7.498879 -6.650005 -6.8333406	0.1873145 0.22193845 0.2990038 0.32655138 0.32655138 0.3866373 0.821558 0.7953381 0.4014333 0.48274052 1.0828626 1.2330383 1.0016379 0.4612032	



OUTPUT AND DIAGNOSTICS

Gauss Strain for solids

Gauss and Corner option for Stress/Strain in composites

Corner option for Composite Stress

Corner option for Strain results in Transient

Gauss and Corner option for Neuber results in linear analysis

Neuber Stress/Strain for Frequency Response and Transient Filter option for displacement output request Static and Buckling Punch and H3D file

PSD/RMS Principal Stress H3D file

Mass Matrix Output (.mgg) PARAM, PRTMGG,YES

Plastic Energy output with Neuber "PLAS" keyword is added in ESE H3D support Neuber option for GPSTRESS/GPSTRAIN

RMS Stress/Strain for composite

ERP output in SE residual run

ESE output in SE residual run for Frequency response and transient

Energy output for small displacement analysis

Additional result types output on the fly (NLMON) STRESS, STRAIN, CSTRESS, CSTRAIN, CONTACT

REPCASE with H3D output

SPCF for intermediate steps in OPTI format for LGDISP analysis

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QUESTIONS?

