PERMAS

News in Version 17

rigid body motion
velostate load
frictional forces
Twisting deformation

Tightening

Unscrewing

Thread Definition on Smooth Bolt Surface

SPR Stresses (Smooth Patch Recovery)

Classical element stresses

Visco-Elastic Material in Dynamics

$$E(f) = E_0 + \sum_{i=1}^{n} \frac{i \cdot 2\pi E_i \cdot f}{\left(i \cdot 2\pi \cdot f\right) + E_i / C_i}$$

... using Prony series

Contact status and contact forces

Normal Friction

Tightening

Unscrewing

Smoothed element stresse.
In addition, stress gradients
on the surface are also available.

Absolute error indicator
(difference between
classical and SPR stresses)

Design by Simulation

Design by topology optimization

Add new part to assembly

Shape optimization

Additional Local Coordinate Systems

HELIX

Effect in frequency and time domain

Frequency [Hz]

Time [s]

Faster NVH Analysis

DOF 20,300,000
Nodes 4,100,000
Elements 4,400,000
Modes 7,300
(up to 800 Hz)

For the generation of threads on smooth bolts with friction

THREAD

High Performance in Contact Analysis, HPCA

Optimization of Composites

Design area
Load
Model
Non-design area
SPC

3:20
Response
MLDR
V16
1023 GiB

1*E5-2697
(18 cores)

/ 1.9

1:46
/ 1.2
/ 2.1
V17
665 GiB

TRIA-to-QUAD Interpolation

Fully quadratic contact
and stress evaluation

35:00
V15

1.8

19:30
V15
+K20c
2*E5-2680
16 cores

4.05

8:38
V16
PCI SSD
2*E5-2699
44 cores

7.3

4:48
V17
PCI SSD
4*X8180
112 cores
CPU/Elapsed
= 62.5

Laminate Analysis with ELT

Extended Laminate Theory
takes transverse shear
into account

Contact analysis with
56 Million DOF, 37 time steps,
2 different temperature states,
and CAS files.

Optimization of ply shapes

0°/90° dominated areas

±45° dominated areas

DE 1
DE 2
DE 3
DE 4
DE 5
DE 6

Optimization of weight
under displacement
constraints

Generalized Inertia Relief

Optimization of ply stacks

Symmetric laminate and
plies for 0°, 90°, ±45°

Restriction for
sum of ply
thicknesses

Optimization of weight under
displacement constraints and
ply failure criterion

New parts added or existing parts replaced, all steps supported to get a clean model.

Import

Linearized contact
and stress evaluation

Ply stack

$E_1 = 1.\ 10^5$, $\nu_{12} = 0.4$
$E = 5.\ 10^4$, $\nu = 0.3$
$G_{12} = 3.\ 10^3$

Add & Replace Wizard

Remove

Extended Use of Third Party Software

Result	Position	NAFEMS	PERMAS	Difference
z-deflection u_z	E	-1.06	-1.067	+0.7%
Bending stress σ_{xx}	E	683.9	682	-0.3%
Transverse shear stress σ_{xz}	D	-4.1	-4.06	-1.0%

Comparison with
NAFEMS benchmark

Extension of Standard Beam Cross Sections

... by two solid cross sections

PERMAS
Condensation
CB Model
MBS
Disp(t)
Gen Stress
Sig(t), dSig(t)/dn
Fatigue

Re-import of MBS results
for stress analysis inside PERMAS,
and subsequent invoking of
fatigue life analysis from
within PERMAS

... as busy as a bee!

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