PERMAS

News in Version 17

rigid body motion
velostate load
frictional forces
Twisting deformation

Tightening

Unscrewing

Thread Definition on Smooth Bolt Surface

Contact status and contact forces

Normal Friction

Tightening

Unscrewing

Design by Simulation

Design by topology optimization

Add new part to assembly

Shape optimization

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

TRIA-to-QUAD Interpolation

Fully quadratic contact and stress evaluation

Linearized contact and stress evaluation

Smoothed element stresse.

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

Additional Local Coordinate Systems

HELIX

SPR Stresses (Smooth Patch Recovery)

Classical element stresses

Absolute error indicator (difference between classical and SPR stresses)

Visco-Elastic Material in Dynamics

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

... using Prony series

Effect in frequency and time domain

Frequency [Hz]

Time [s]

High Performance in Contact Analysis, HPCA

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
2*X8180
112 cores
CPU/Elapsed = 62.5

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

Laminate Analysis with ELT

Extended Laminate Theory takes transverse shear into account

Ply stack

$E_t = 1.\ 10^7$, $\nu_{ti} = 0.4$
$E = 5.\ 10^7$, $\nu = 0.3$
$G_{ti} = 3.\ 10^7$

Optimization of Composites

Design area
Load
Model
Non-design area
SPC

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

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

3:20 Response MLDR V16 1023 GiB
1*E5-2697 (18 cores)
/ 1.9
1:46
/ 1.2
/ 2.1 V17 665 GiB

Generalized Inertia Relief

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

Import

Add & Replace Wizard

Remove

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

Extended Use of Third Party Software

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

Extension of Standard Beam Cross Sections

... by two solid cross sections

... as busy as a bee!

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