



# GEMS

Gleason Engineering & Manufacturing System

# KISSSOFT

Calculation Programs for Machine Design

# System Design Data Interface

# Two Software Solutions / One Common Goal

## KISSsys: Design of Transmissions

### Kinematic Calculation

- Standard and shifted transmissions.
- Differentials, power split.

### Load Capacity of the Transmission

- Life time and strength calculation of gears, shafts, rolling bearings.
- Load spectra and damages.

### Efficiency and Thermal Rating

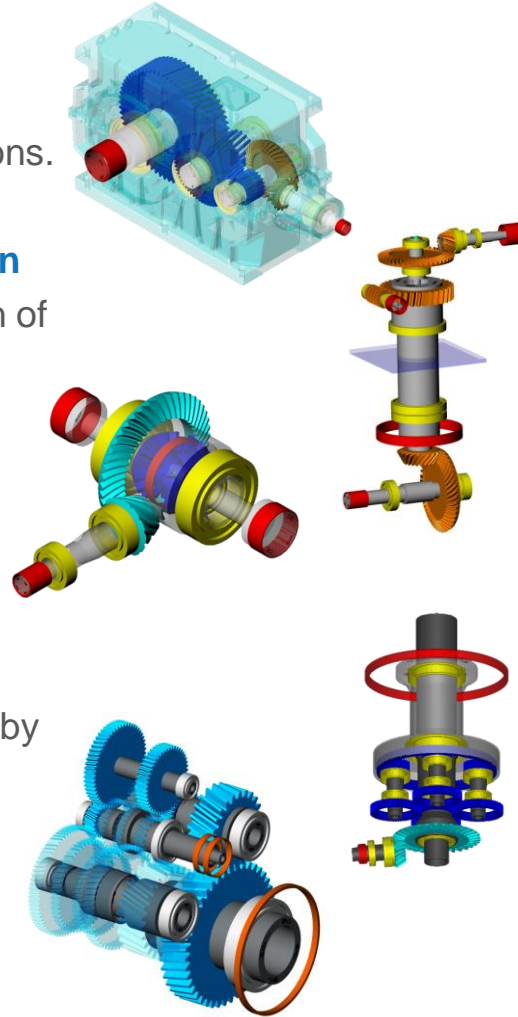
- Power loss and efficiency calculation.
- Heat transfer by the casing, etc..

### Housing Stiffness

- Housing compliance considered by stiffness matrix.

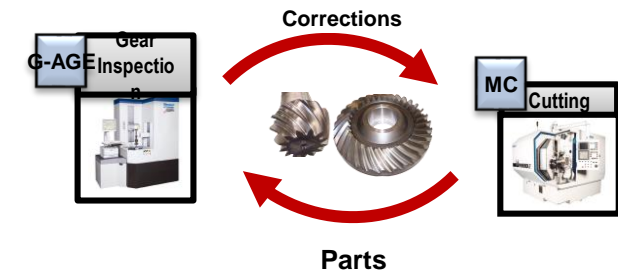
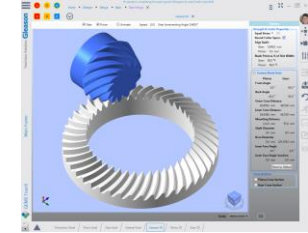
### Dynamics of Shaft Systems

- Modal analysis.
- Campbell diagram.



## GEMS: Calculation and Manufacturing of Bevel and Hypoid Gears

- Design and analysis of spiral bevel & hypoid gears.
- Establishment of data for Gleason gear production machines.
- Establishment of data for Gleason blade grinding machines.
- Closed Loop to manage manufacturing processes.



# Two Software Solutions / Complimentary Process for Bevel and Hypoid Design

## KISSsoft: Design Manufacturing Process

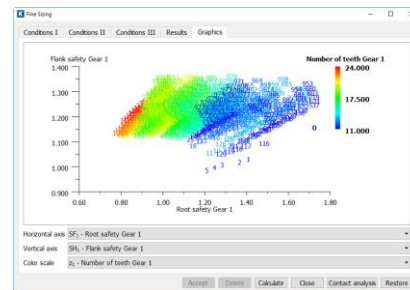
### Geometry and Strength Calculation

- ISO 23509, ISO 10300:2014, DIN, AGMA, DNV, Klingelnberg Werksnorm, static, flank fracture.



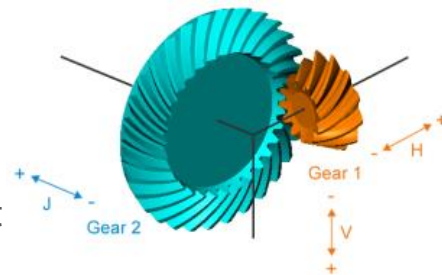
### Sizing

- Variation of macro geometry as spiral angle, pressure angle, ..
- Results shown for all variants as safeties, bearing forces, efficiency.
- Specific parameters for differential bevel gears.



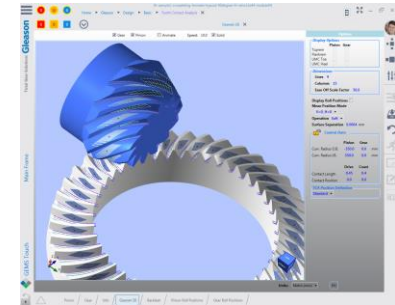
### Bevel gears in systems

- EPG (VHJ) values from pinion and wheel shafts.
- Misalignment values including shaft bending, bearing stiffness, housing deformation, thermal effects.



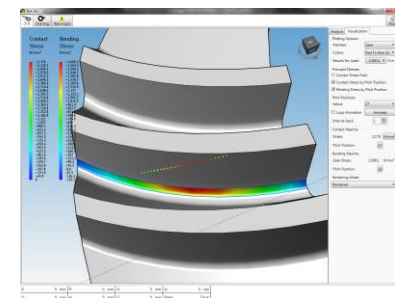
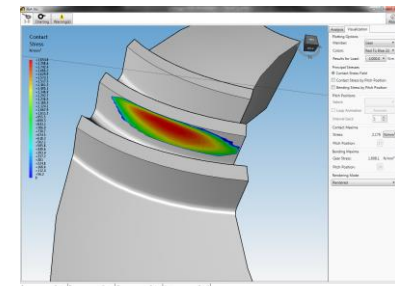
### Open Design, Seamless Connectivity

- Easily connect to, and transfer data with, CAGETM, UNICAL, and common design software.
- Import design data files from CAGE and UNICAL.
- Connect with GEMS on-line via web app.

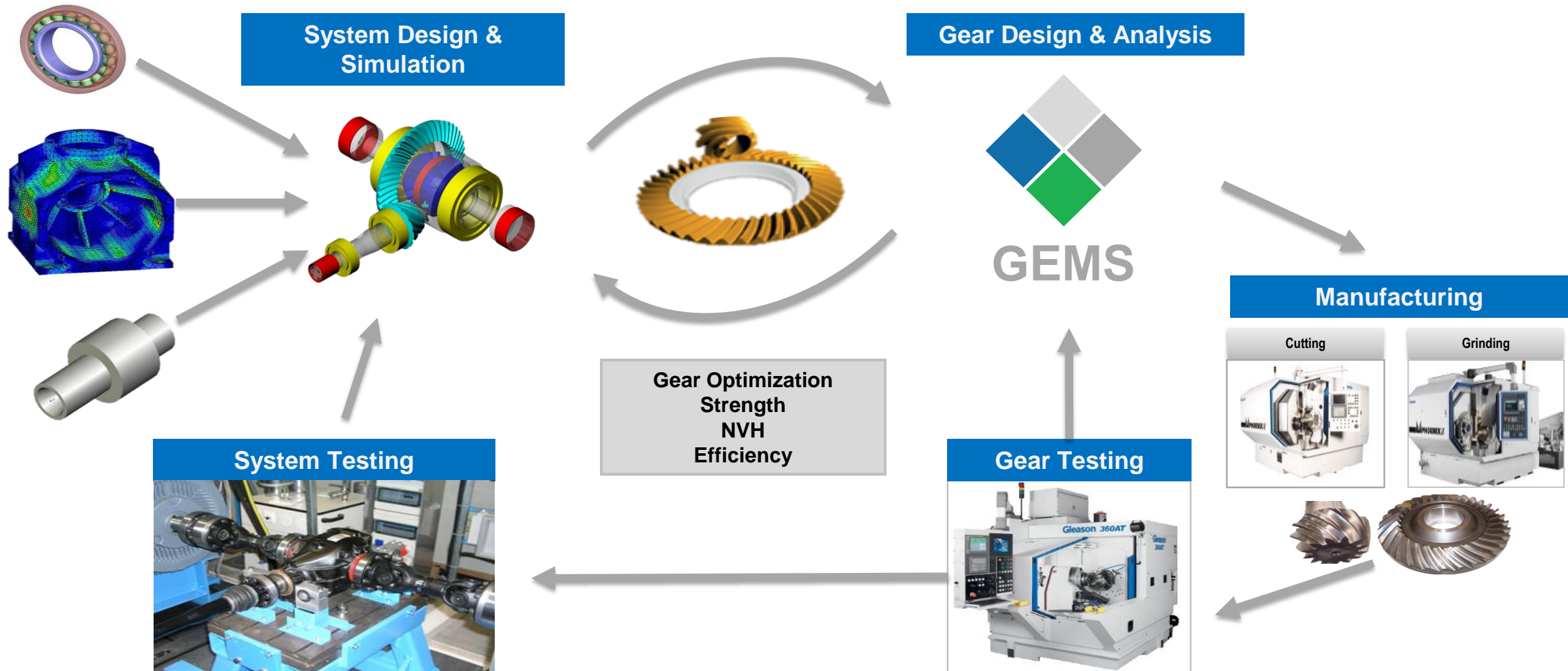


### Powerful New Features

- Interface with GEMS through touchscreen or conventional mouse/keyboard.
- 3D gear and pinion graphics with animation.
- Combined ease-off and TCA for pinion and gear.
- Interactive tooth surface and ease-off correction and optimization.
- Real blank geometry for both pinion and gear.
- 2D tooth profiles along the face width.
- 2D/3D loaded TCA, including interactive root bending stress and contact stress output with S-N Curves.
- Interactive tool design with graphical slot and blade output.



# System Design Loop / KISSsys using GEMS



# Customer Value Proposition / System Design + Gear Design + Manufacturing

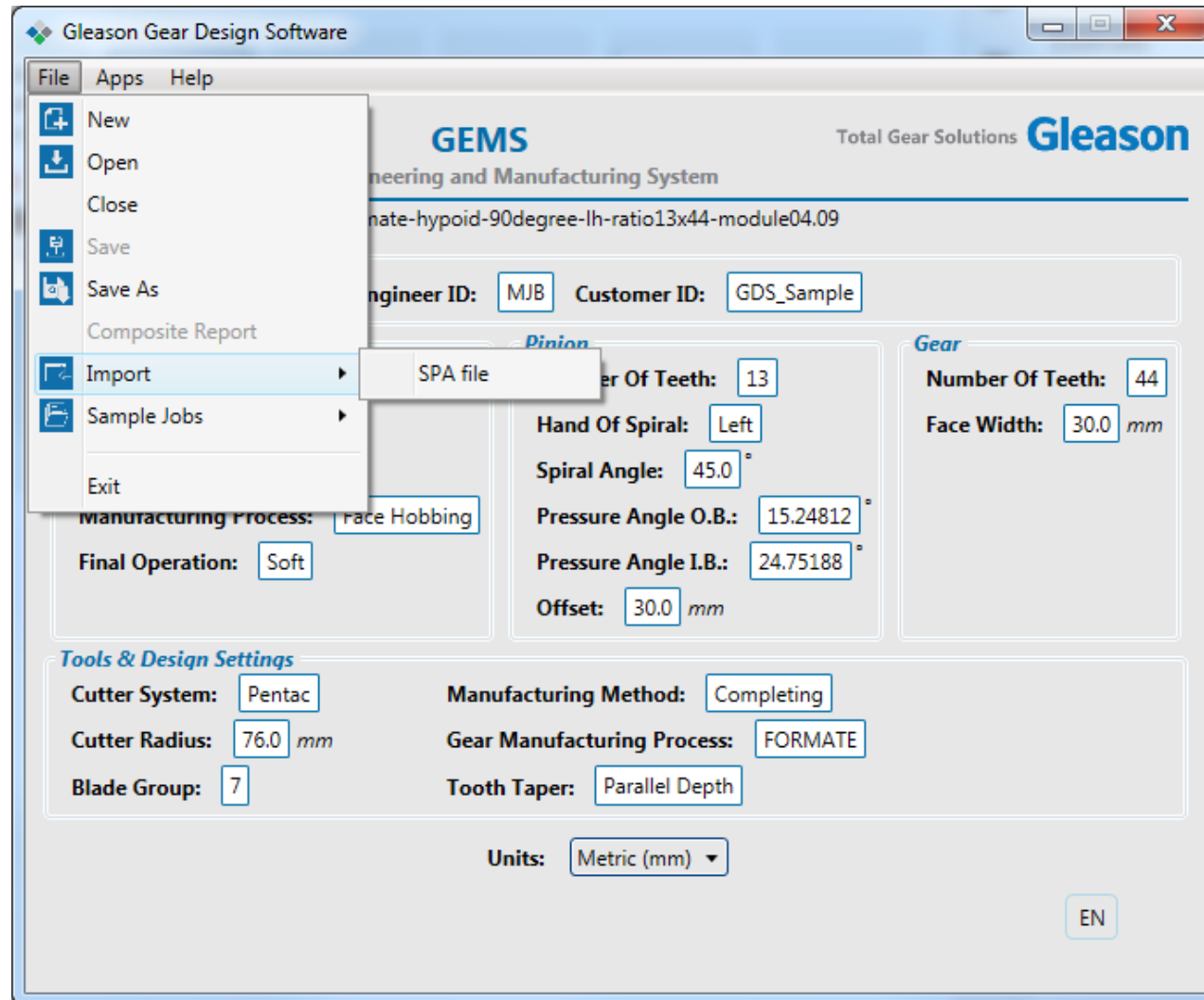
Dramatically improve customer experience, human efficiency, and part quality by connecting System Design, Gear Design, and Gear Manufacturing Software Systems.



# Export Gear Geometry from GEMS to KISSsoft

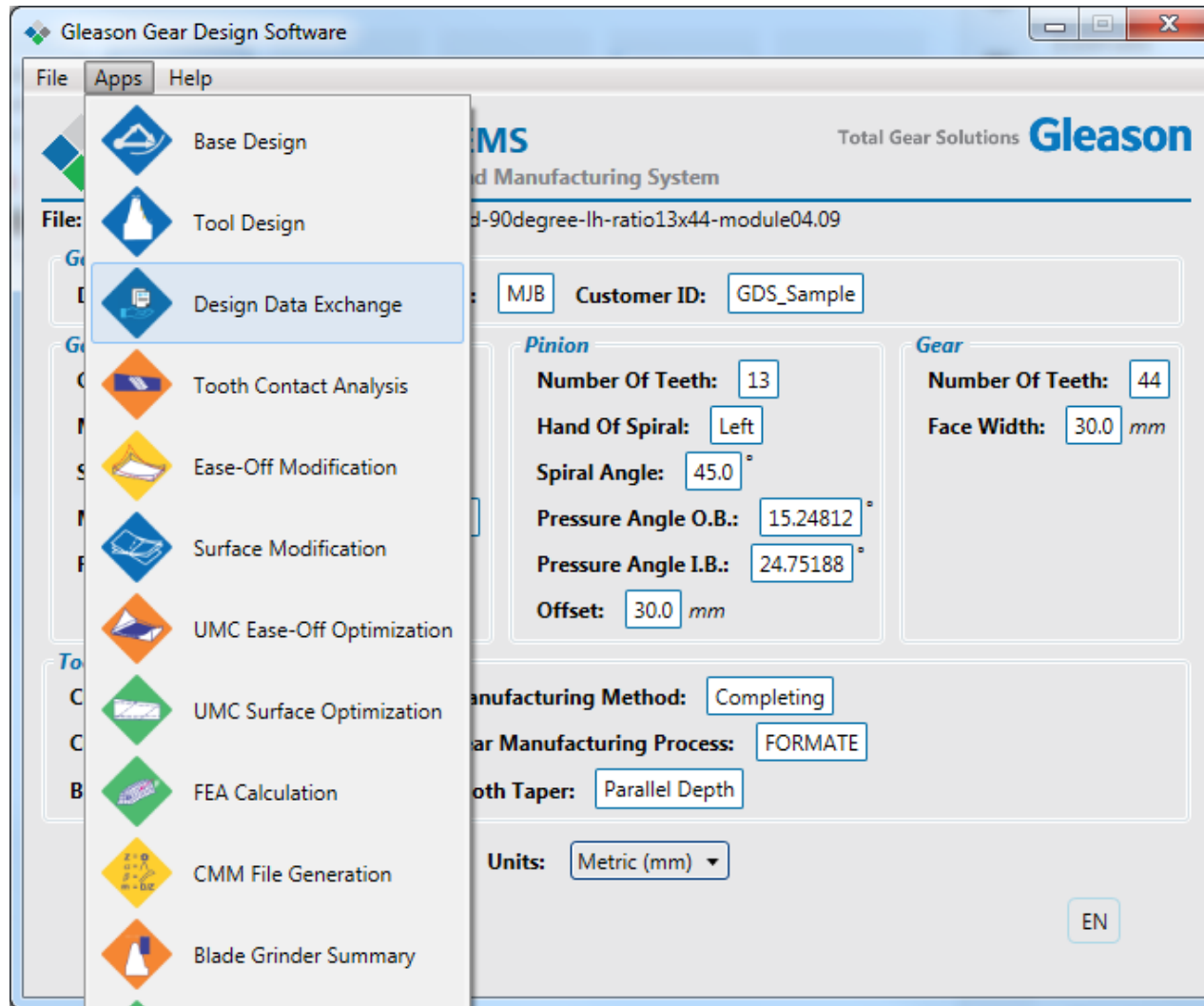


# Export Gear Geometry from GEMS to KISSsoft



- Import SPA file

# Export Gear Geometry from GEMS to KISSsoft



- Select Design Data Exchange



# Export Gear Geometry from GEMS to KISSsoft

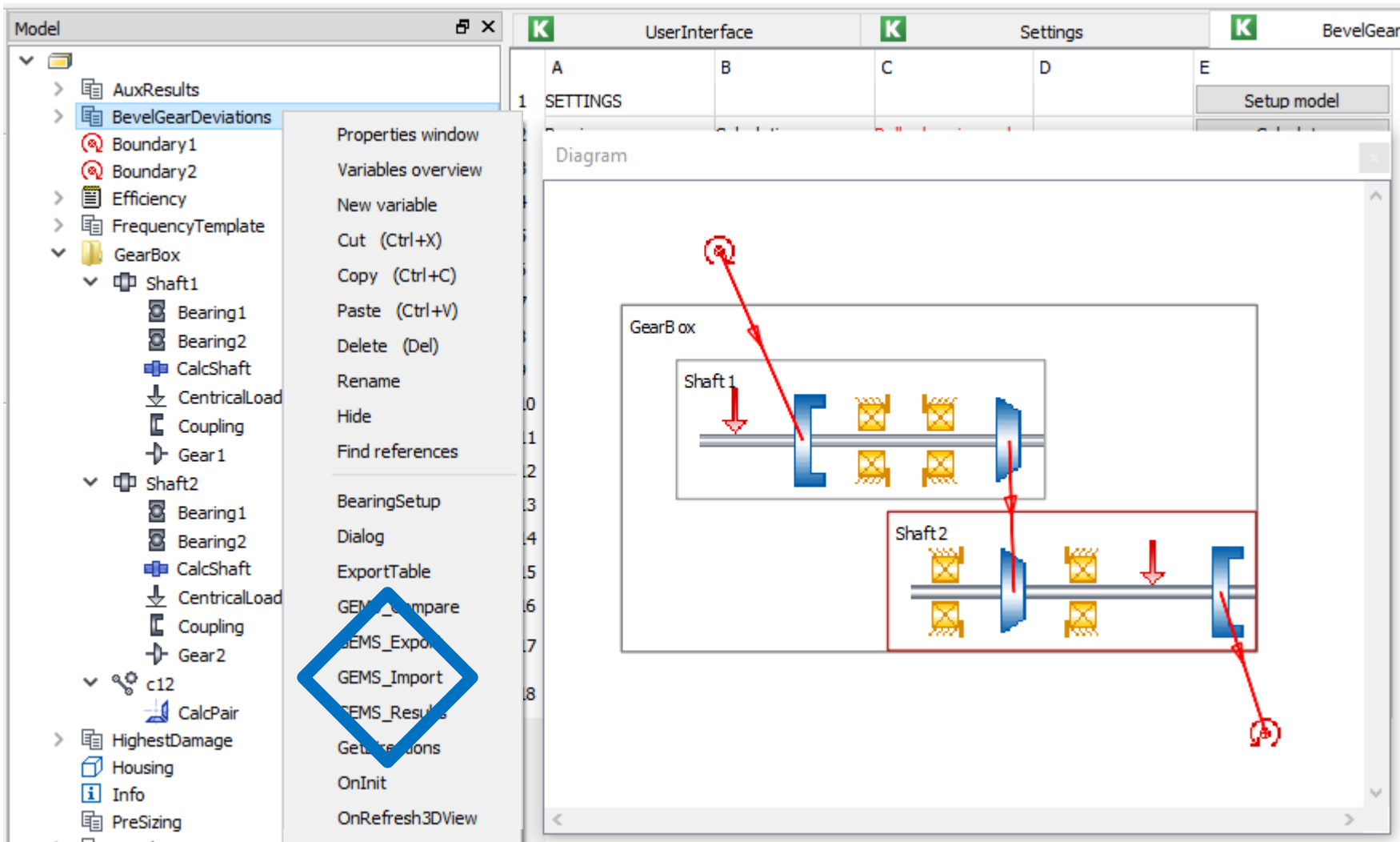
The screenshot shows the GEMS Design Data Exchange (DDE) window. The main area is a table with columns for Pinion, Gear, and Unit. The table contains various gear parameters such as Number Of Teeth, Shaft Angle, Hypoid Offset, Mean Normal Module, Outer Transverse Module, Mean Spiral Angle, Pitch Angle, Face Angle, Root Angle, Nominal Pressure Angle Drive, Nominal Pressure Angle Coast, Limit Pressure Angle, Spiral Hand, Face Width, Mean Pitch Cone Distance, Outer Pitch Cone Distance, Outer Pitch Diameter, Outside Diameter, Mean Addendum Coefficient, Mean Dedendum Coefficient, Mean Clearance Coefficient, Profile Displacement Factor, Tooth Thickness Factor, and Mean Whole Depth. On the right side, there is an 'Options' panel with an 'Export' button highlighted by a blue diamond. Below the 'Export' button is an 'Import' button, a 'Show XML' checkbox, and 'Mounting Distance (mm)' input fields for Pinion (95.28092) and Gear (44.48634). At the bottom of the window, there is a 'Run' button, a 'Units' dropdown menu set to 'Metric (mm)', an 'EN' button, and a 'Close' button.

	Pinion	Gear	Unit
Number Of Teeth	13	44	
Shaft Angle	90.0		°
Hypoid Offset	30.0		mm
Mean Normal Module	3.329	3.346	mm
Outer Transverse Module	5.893	4.364	mm
Mean Spiral Angle	45.585	25.407	°
Pitch Angle	23.601	65.043	°
Face Angle	26.983	66.381	°
Root Angle	22.32	61.228	°
Nominal Pressure Angle Drive	17.79	17.79	°
Nominal Pressure Angle Coast	22.21	22.21	°
Limit Pressure Angle	-2.503	0.0	°
Spiral Hand	Left	Right	
Face Width	36.86	32.0	mm
Mean Pitch Cone Distance	76.631	89.263	mm
Outer Pitch Cone Distance	95.666	105.896	mm
Outer Pitch Diameter	76.604	192.016	mm
Outside Diameter	88.813	193.289	mm
Mean Addendum Coefficient	1.0	1.0	
Mean Dedendum Coefficient	1.313	1.35	
Mean Clearance Coefficient	0.157	0.175	
Profile Displacement Factor	0.66	-0.66	
Tooth Thickness Factor	0.01	0.01	
Mean Whole Depth	7.775	7.929	mm



- Export Geometry Data as presented in new window

# Import Gear Geometry Data in KISSsoft



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- Create system model in KISSsys
- Import GEMS data

# Import Gear Geometry Data in KISSsoft



Calculation Programs for Machine Design

Basic data Manufacturing Reference profile Tolerances Modifications Rating Factors

Configuration

Type: Constant slot width, fig 2 (Gleason-Duplex)

Geometry

		Gear 1		Gear 2	
Mean normal module	$m_{mn}$	3.3463	mm		
Outer pitch diameter gear 2	$d_{e2}$	193.4596	mm		
Pressure angle at normal section	$\alpha_n$	20.0000	°		
Gear 1		helix left hand (spiral teeth)			
Mean spiral angle gear 1	$\beta_{m1}$	45.5851	°		
Addendum angle gear 2	$\theta_{a2}$	1.3382	°		
Dedendum angle gear 2	$\theta_{d2}$	3.8151	°		
		Number of teeth	$z$	13	44
		Facewidth	$b$	36.7645	32.0000 mm
		Profile shift coefficient	$x_{hmn}^+$	0.6600	-0.6600
		Tooth thickness modification factor	$x_{amn}^+$	0.0102	0.0103
		Quality (ISO 17485)	$Q$	6	6
		Shaft angle	$\Sigma$		90.0000 °
		Hypoid offset	$a$		30.0000 mm

Material and lubrication

Gear 1: 18CrNiMo7-6, Case-carburized steel, case-hardened, ISO 6336-5 Figure 9/10 (MQ), Core hardness  $\geq 25\text{HRC}$  Jominy J=12mm <HRC28

Gear 2: 18CrNiMo7-6, Case-carburized steel, case-hardened, ISO 6336-5 Figure 9/10 (MQ), Core hardness  $\geq 25\text{HRC}$  Jominy J=12mm <HRC28

Lubrication: Oil: ISO-VG 100, Oil bath lubrication

- This will update the gear data in KISSsoft to match the GEMS definition

# Import Gear Geometry Data in KISSsoft

	A	B	C	D	E
1	SETTINGS				Setup model
2	Bearings	Calculation	Roller bearings, classi		Calculate
3		Use linear stiffness	no		Create files
4	Presentation	Draw deflection lines	no		Export deflection
5		Deflection scale		1000	Load on: Drive Side
6					
7	RESULTS				
8	Local deflections	x [mm]	z [mm]	y [mm] (axial)	fa [mm] (axial deviation)
9	Pinion	0.019224	0.016811	-0.011764	0
10	Gear	0.0018839	-0.0019446	-0.010652	0
11					
12	Global deflections	E [mm]	P [mm]	G [mm]	Gleason (EPG)
13	Total (contact point)	-0.021361	0.013648	-0.0059354	(define manually)
14	Pinion	-0.019417	0.011764	-0.016588	
15	Gear	-0.0019446	0.0018839	0.010652	
16					
17	Deviations	fa [mm]	fs1 [mm]	fs2 [mm]	fsigma [deg]
18	Total (crossing point)	-0.072063	0.013273	-0.054631	0.040185

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- It will then run each load case specified and export all corresponding misalignment information

# Export Gear Geometry from KISSsoft to GEMS

# Export Gear Geometry from KISSsoft to GEMS

The screenshot shows the KISSsoft software interface. On the left, a tree view displays the model structure, including 'GearBox', 'Shaft1', 'Shaft2', and 'c12'. A context menu is open over the 'GearBox' folder, with 'GEMS\_Export' highlighted by a blue diamond. The central window shows a 3D rendering of a gear assembly. On the right, a 'PreSizing' panel contains buttons for 'Setup model', 'Calculate', 'Create files', and 'Export deflection'. Below the 3D view, a table displays global deflections and deviations.

Global deflections	E [mm]	P [mm]	G [mm]	
Total (contact point)	-0.021361	0.013648	-0.0059354	Gleason (EPG) (define manually)
Pinion	-0.019417	0.011764	-0.016588	
Gear	-0.0019446	0.0018839	0.010652	
Deviations	fa [mm]	fs1 [mm]	fs2 [mm]	fsigma [deg]
Total (crossing point)	-0.072063	0.013273	-0.054631	0.040185

# KISSSOFT

Calculation Programs for Machine Design

- It is also possible to directly export the gear geometry defined in KISSsoft together with the load cases results

# Import Load Cases in GEMS

# Import Load Cases

The screenshot shows the GEMS Design Data Exchange (DDE) window. The title bar reads "SPA: fm-sample1-completing-formate-hypoid-90degree-lh-ratio13x44-module04.36". The window has a "File Name" field containing "F:\DesktopSave\fm-sample1-test.xml". Below this, there are tabs for "Geometry" and "Misalignments and Loads". A table displays the following data:

Case	Member	Cycles	Torque (N·m)	Speed (rpm)	$\Delta\Sigma$ (°)	$\Delta E$ (mm)	$\Delta X_p$ (mm)	$\Delta X_w$ (mm)
1	Pinion	300000000	50.0	1500.0	0.0407	-0.0722	0.0135	-0.0562
2	Pinion	300000000	200.0	-1800.0	0.0407	-0.0422	0.0235	-0.0772

On the right side, there are "Export" and "Import" buttons. The "Import" button is highlighted with a blue diamond. Below these buttons is a "Show XML" checkbox and a "Mounting Distance (mm)" section with input fields for "Pinion" (95.28092) and "Gear" (44.48634). At the bottom, there is a "DDE" section with a "Run" button, a "Units" dropdown set to "Metric (mm)", an "EN" button, and a "Close" button.



- Import Load Cases (Open GEMS DDE first then select import)



# Run FEA Application

SPA: fm-sample1-completing-formate-hypoid-90degree-lh-ratio13x44-module04.36

Design Data Exchange

File Name: F:\DesktopSave\fm-sample1-test.xml

Geometry | Misalignments and Loads

Case	Member	Cycles	Torque (N·m)	Speed (rpm)	$\Delta\Sigma$ (°)	$\Delta E$ (mm)	$\Delta X_p$ (mm)	$\Delta X_w$ (mm)
1	Pinion	300000000	50.0	1500.0	0.0407	-0.0722	0.0135	-0.0562
2	Pinion	300000000	200.0	-1800.0	0.0407	-0.0422	0.0235	-0.0772

Export

Import

Show XML

Mounting Distance (mm)

Pinion: 95.28092

Gear: 44.48634

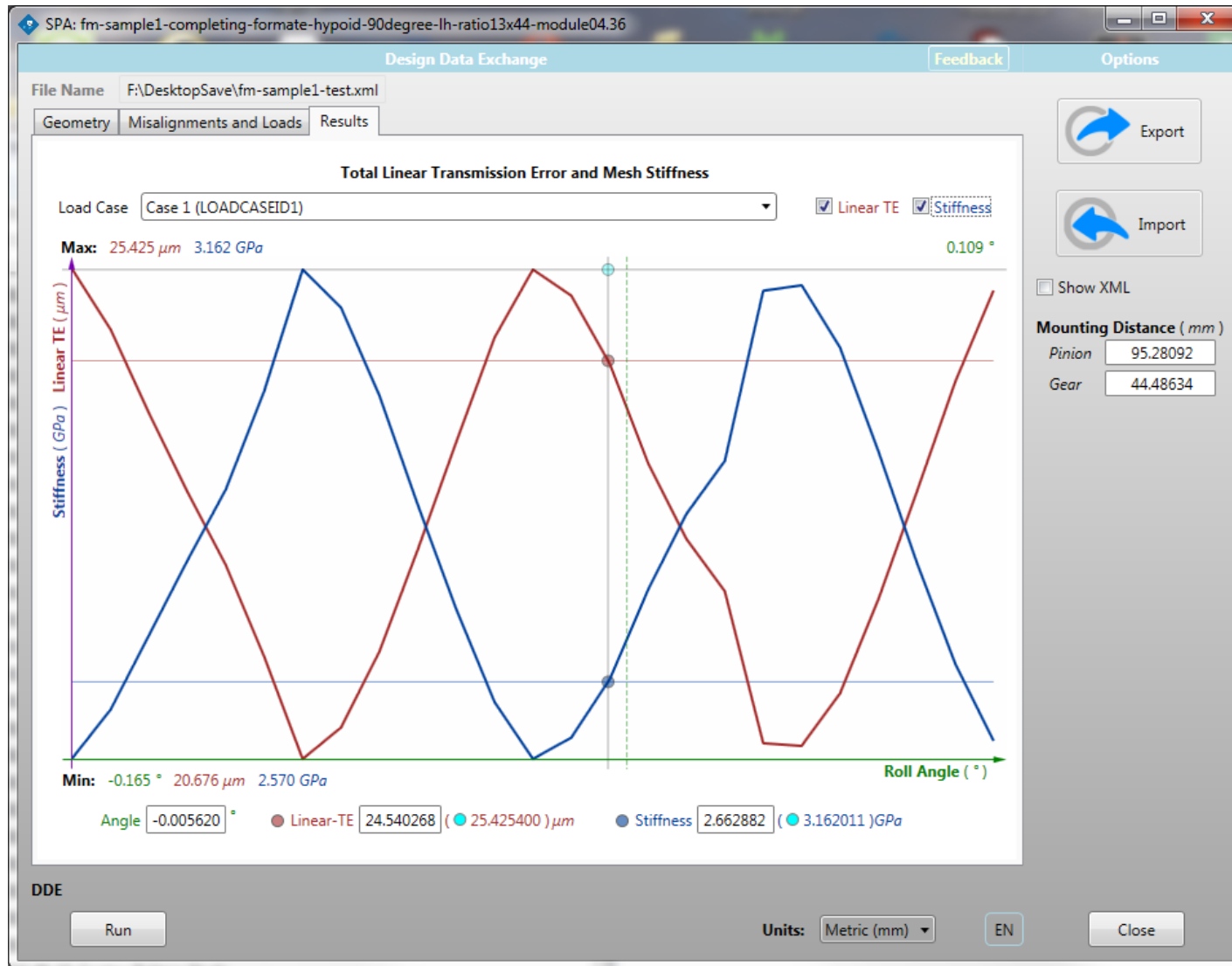
Run

Units: Metric (mm) EN Close



- Imported load case file must match loaded design file. Press RUN when file loaded to execute the FEA application

# Transmission and Stress Results



- Results generated. Export to use in designer

# Import Load Cases Results in KISSsoft

# Inclusion of Analysis Results

# KISSsoft

Calculation Programs for Machine Design

- Import Stress and TE results
- Continue to run NVH analysis

The screenshot displays the KISSsoft software interface. On the left is a tree view of the model structure, including folders for 'AuxResults', 'BevelGearDeviations', 'LoadCases', 'Results', 'Boundary1', 'Boundary2', 'Efficiency', 'FrequencyTemplate', 'GearBox', 'Shaft1', and 'Shaft2'. The 'BevelGearDeviations' folder is expanded, and a context menu is open over it, with 'GEMS\_Results' highlighted by a blue diamond. The main window shows a table with columns A, B, C, D, and E. The table contains settings for 'SETTINGS', 'Calculation', 'Roller bearings, class', 'Use linear stiffness no', 'Draw deflection lines no', and 'Deflection scale 1000'. Below the table, there are buttons for 'Setup model', 'Calculate', 'Create files', and 'Export deflection'. Two windows are overlaid on the main interface: 'TransmissionError' showing a line graph of transmission error in micrometers versus angle of rotation in degrees, and 'Contact Pressure' showing a color-coded pressure distribution on a gear tooth profile.

A	B	C	D	E
1	SETTINGS			
	Calculation	Roller bearings, class		Setup model
	Use linear stiffness	no		Calculate
	Draw deflection lines	no		Create files
	Deflection scale	1000	Load on:	Export deflection
			Drive Side	