[2] involuteΣ Bevel Gear Design System

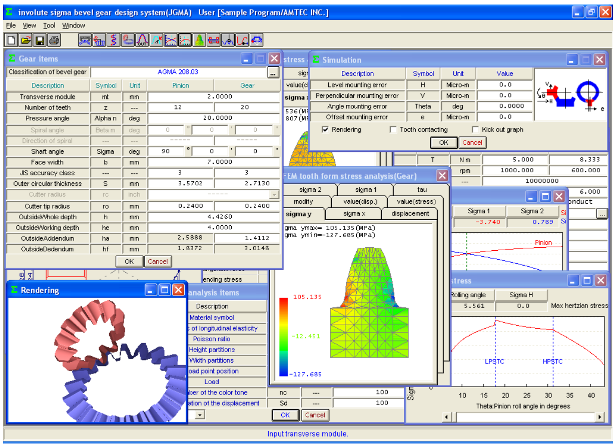


Fig. 2.1 involuteΣ Bevel Gear Design System

2.1 Introduction

The ***involuteΣ Bevel Gear Design System*** is a complete design system for bevel gears. It offers Gear Dimension, Strength Calculation (Metal or Resin), Tooth Profile Rendering, Assembly Drawing, Bearing Load Calculation, Sliding Ratio Graph, Hertzian Stress Graph, Profile Tooth Stress Analysis, Tooth Contact Area Display, Measurement Data Output, and many other features.

2.2. Software Features

Table 2.1 shows the available software features offered.

Table 2.1. Software Features

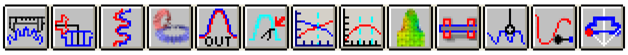
Item	Page	Straight	Spiral
<1> Gear Dimension	8	○	
<2> Gear Meshing Drawing	8	○	
<3> Gear Assembly Drawing	8	○	
<4> Tooth Profile DXF File Output	8	○	
<5> Strength Calculation (Metal)	9	○	
<6> Strength Calculation (Resin)	---	○	
<7> Gear Accuracy	9	○	
<8> Design Data Control	---	○	
<9> Tooth Profile Rendering	10	○	
<10> Sliding Ratio Graph	11	◎	
<11> Hertzian Stress Graph	11	◎	
<12> Crossed Axes Angle (Acute)	11	◎	
<13> 3D Tooth Profile Coordinate Output	10	◎	
<14> Tooth Profile IGES File Output[1]	11	◎	
<15> Tooth Profile IGES File Output for FEM Analysis[1]	11	◎	
<16> Assembly Error Simulation	11	◎	
<17> Over-Ball Diameter Measurement[1]	10	◎	×
<18> 2D-FEM Tooth Profile Stress Analysis[1]	10	◎	×
<19> Tooth Profile Measurement[1]	11	◎	
<20> Tooth Contact Area[1]	11	◎	
<21> STL File Output[1]	11	◎	
<22> Crossed Axes Angle (Acute)	---	◎	
<23> Chamfer Shape	9	◎	
<24> Kick Out Graph	10	◎	
<25> Minimum of 9 Teeth	---	◎	

○ (Supported as standard) ◎ (Optional)

1) "<13> 3D Tooth Profile Coordinate" software is required.

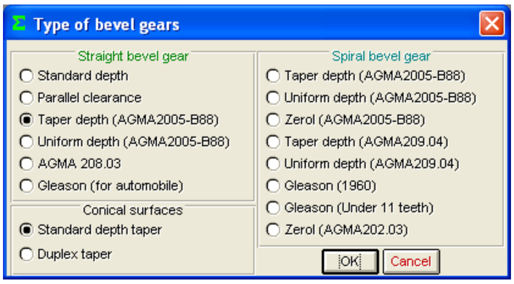
2.3 Icon Buttons

The toolbar contains 13 icon buttons including [Dimension], [Assembly], [Profile], and [Rendering].



2.4 Supported Gear Types

The System supports 14 types of bevel gears: six spur bevel gears and eight spiral bevel gears. Fig. 2.2 shows the supported bevel gear types.



Type of bevel gears

Straight bevel gear
- ○ Standard depth
- ○ Parallel clearance
- ● Taper depth (AGMA2005-B88)
- ○ Uniform depth (AGMA2005-B88)
- ○ AGMA 208.03
- ○ Gleason (for automobile)

Conical surfaces
- ● Standard depth taper
- ○ Duplex taper

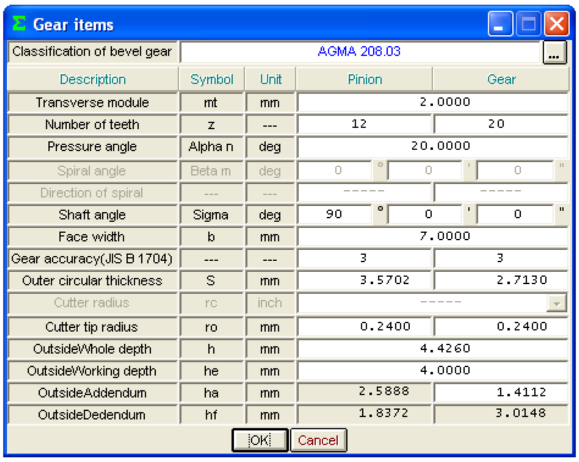
Spiral bevel gear
- ○ Taper depth (AGMA2005-B88)
- ○ Uniform depth (AGMA2005-B88)
- ○ Zerol (AGMA2005-B88)
- ○ Taper depth (AGMA209.04)
- ○ Uniform depth (AGMA209.04)
- ○ Gleason (1960)
- ○ Gleason (Under 11 teeth)
- ○ Zerol (AGMA202.03)

Fig. 2.2 Supported Bevel Gear Types

2.5 Gear Dimensions

Selecting a bevel gear type in Fig. 2.2 displays the Gear dimension input screen as shown in Fig. 2.3. After specifying the module and number of teeth of the pinion/gear, pressing the TAB key sets the default values for the remaining items (editable). The System not only supports shaft angles of other than 90 degrees, but also calculates the inclined and constant height teeth.

The Modified gear dimension input screen shown in Fig. 2.4 allows the user to specify the tip modification and crowning data and change the tip and root angles of the bevel gear as desired.

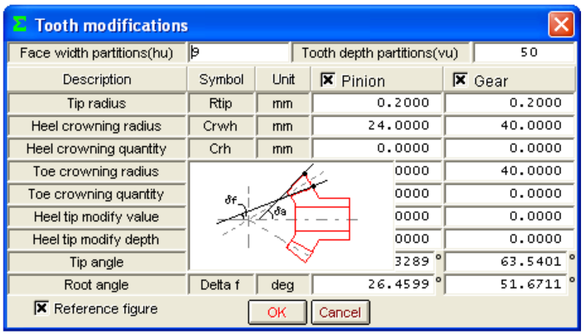


Gear items

Classification of bevel gear: AGMA 208.03

Description	Symbol	Unit	Pinion	Gear
Transverse module	mt	mm	2.0000	
Number of teeth	z	---	12	20
Pressure angle	Alpha n	deg	20.0000	
Spiral angle	Beta m	deg	0 ° 0 ' 0 "	
Direction of spiral	---	---	-----	-----
Shaft angle	Sigma	deg	90 ° 0 ' 0 "	
Face width	b	mm	7.0000	
Gear accuracy(JIS B 1704)	---	---	3	3
Outer circular thickness	S	mm	3.5702	2.7130
Cutter radius	rc	inch	-----	
Cutter tip radius	ro	mm	0.2400	0.2400
OutsideWhole depth	h	mm	4.4260	
OutsideWorking depth	he	mm	4.0000	
OutsideAddendum	ha	mm	2.5888	1.4112
OutsideDedendum	hf	mm	1.8372	3.0148

Fig. 2.3 Gear Dimension Input Screen



Tooth modifications

Face width partitions(hu): 9
Tooth depth partitions(vu): 50

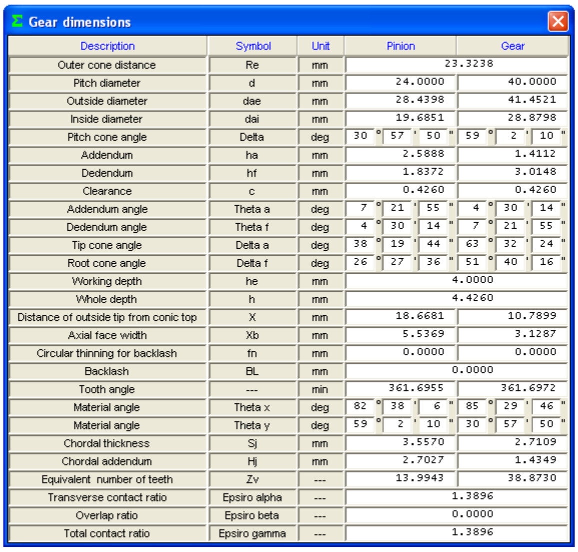
Description	Symbol	Unit	☒ Pinion	☒ Gear
Tip radius	Rtip	mm	0.2000	0.2000
Heel crowning radius	Crwh	mm	24.0000	40.0000
Heel crowning quantity	Crh	mm	0.0000	0.0000
Toe crowning radius			0000	40.0000
Toe crowning quantity			0000	0.0000
Heel tip modify value			0000	0.0000
Heel tip modify depth			0000	0.0000
Tip angle			3289 °	63.5401 °
Root angle	Delta f	deg	26.4599 °	51.6711 °

☒ Reference figure

Fig. 2.4 Modified Gear Dimension Input Screen

2.6 Gear Dimensions Calculation

The calculated dimensions of the bevel gear are displayed in the Gear dimension calculation result screen shown in Fig. 2.5.

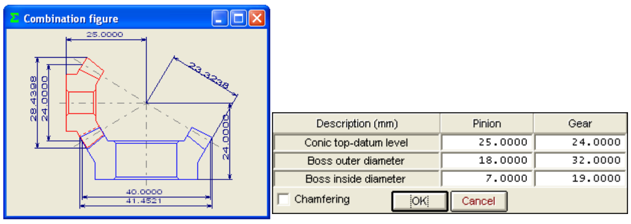


Description	Symbol	Unit	Pinion	Gear
Outer cone distance	Re	mm	23.3238	
Pitch diameter	d	mm	24.0000	40.0000
Outside diameter	dae	mm	28.4398	41.4521
Inside diameter	dai	mm	19.6851	28.8798
Pitch cone angle	Delta	deg	30° 57' 50"	59° 2' 10"
Addendum	ha	mm	2.5888	1.4112
Dedendum	hf	mm	1.8372	3.0148
Clearance	c	mm	0.4260	0.4260
Addendum angle	Theta a	deg	7° 21' 55"	4° 30' 14"
Dedendum angle	Theta f	deg	4° 30' 14"	7° 21' 55"
Tip cone angle	Delta a	deg	38° 19' 44"	63° 32' 24"
Root cone angle	Delta f	deg	26° 27' 36"	51° 40' 16"
Working depth	he	mm	4.0000	
Whole depth	h	mm	4.4260	
Distance of outside tip from conic top	X	mm	18.6681	10.7899
Axial face width	Xb	mm	5.5369	3.1287
Circular thinning for backlash	fn	mm	0.0000	0.0000
Backlash	BL	mm	0.0000	
Tooth angle	---	min	361.6955	361.6972
Material angle	Theta x	deg	82° 38' 6"	85° 29' 46"
Material angle	Theta y	deg	59° 2' 10"	30° 57' 50"
Chordal thickness	Sj	mm	3.5570	2.7109
Chordal addendum	Hj	mm	2.7027	1.4349
Equivalent number of teeth	Zv	---	13.9943	38.8730
Transverse contact ratio	Epsiro alpha	---	1.3896	
Overlap ratio	Epsiro beta	---	0.0000	
Total contact ratio	Epsiro gamma	---	1.3896	

Fig. 2.5 Calculated Gear Dimensions

2.7 Gear Assembly Drawing

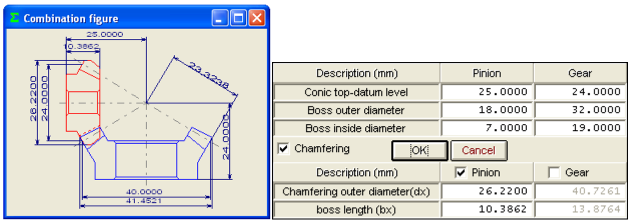
As shown in Fig. 2.6, assembly drawings can be produced by specifying the length and boss diameter information on the pinion and gear pair. Fig. 2.6a is an example of chamfering the outer diameter and boss ends of the pinion for the forging process. In addition, Fig. 2.7 and Fig. 2.8 are drawing examples for setting the shaft angle to 70 degrees and 120 degrees, respectively. Assembly drawings can be output in the DXF file format.



Description (mm)	Pinion	Gear
Conic top-datum level	25.0000	24.0000
Boss outer diameter	18.0000	32.0000
Boss inside diameter	7.0000	19.0000

☐ Chamfering

Fig. 2.6 Gear Assembly Drawing and Settings



Description (mm)	Pinion	Gear
Conic top-datum level	25.0000	24.0000
Boss outer diameter	18.0000	32.0000
Boss inside diameter	7.0000	19.0000

☑ Chamfering

Description (mm)	☑ Pinion	☐ Gear
Chamfering outer diameter(dx)	26.2200	40.7261
boss length (bx)	10.3862	13.8764

Fig. 2.6a Gear Assembly Drawing and Settings (Chamfering)

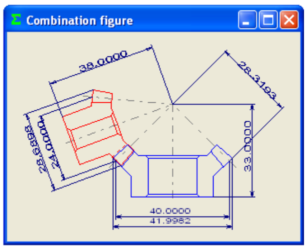


Fig. 2.7 Assembly Drawing

(Shaft Angle = 70 °)

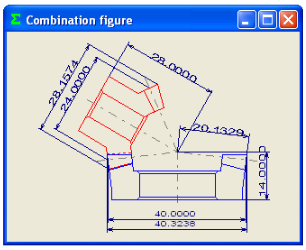
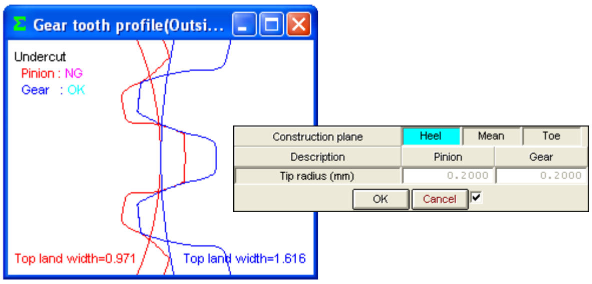


Fig. 2.8 Assembly Drawing

(Shaft Angle = 120 °)

2.8 Gear Profile Drawing

Gear profile drawings showing how the gear is meshed with the pinion at the outer end, center, or inner end can be drawn. Fig. 2.9 is a gear profile meshing drawing for the outer end.



Undercut
Pinion : NG
Gear : OK

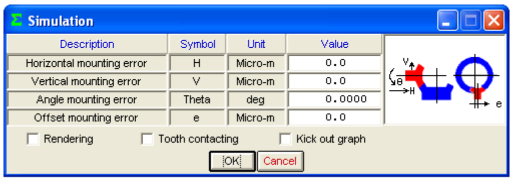
Top land width=0.971
Top land width=1.616

Construction plane	Heel	Mean	Toe
Description	Pinion	Gear	
Tip radius (mm)	0.2000	0.2000	

Fig. 2.9 Gear Meshing Drawing

2.9 Assembly Error Simulation

Improperly assembled gear pair would cause the variation of the point of contact when the pinion and gear are in mesh. By setting the Assembly Error Simulation, the user can observe this variation using the Tooth Profile Rendering and Tooth Contact Variation features to evaluate the impact of horizontal, vertical, angular, and offset errors in the gear assembly.



Description	Symbol	Unit	Value
Horizontal mounting error	H	Micro-m	0.0
Vertical mounting error	V	Micro-m	0.0
Angle mounting error	Theta	deg	0.0000
Offset mounting error	e	Micro-m	0.0

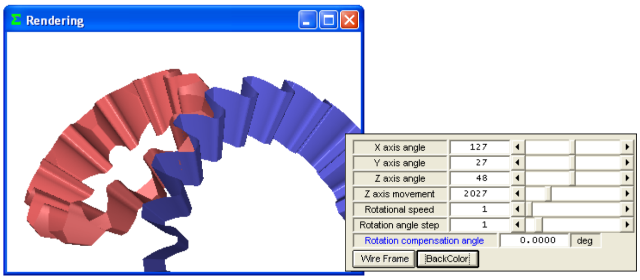
☐ Rendering ☐ Tooth contacting ☐ Kick out graph

Fig. 2.10 Assembly Error Simulation Settings

2.10 Tooth Profile Rendering

3D tooth profiles of the pinion and gear in mesh can be generated as shown in Fig. 2.11. The generated tooth profiles will be based on spherical involutes and theoretical leads. The viewing angle of the image can be changed using the control form shown in Fig. 2.11. Setting the meshing step angle to "1" causes the pinion to rotate in increments of 1 degree; entering "0" produces a still image. The generated profile images are scalable.

Fig. 2.12 and Fig. 2.13 show the 3D rendering images that represent the tooth profiles of spiral bevel and Zerol gears, respectively.



X axis angle	127	
Y axis angle	27	
Z axis angle	48	
Z axis movement	2027	
Rotational speed	1	
Rotation angle step	1	
Rotation compensation angle	0.0000	deg

Fig. 2.11 Tooth Profile Rendering Image and Settings

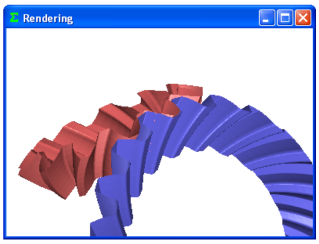


Fig. 2.12 Spiral Bevel Gears

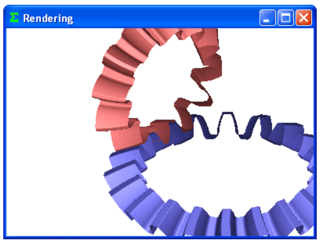
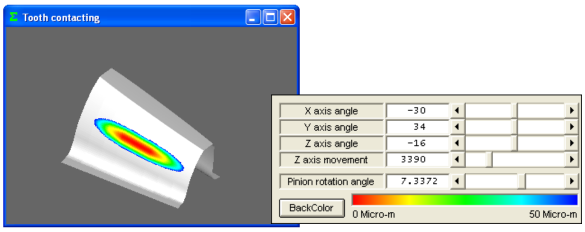


Fig. 2.13 Zerol Gears

2.11 Tooth Contact Variation

Fig. 2.14 shows the point of contact on the pinion tooth flank when crowning is specified on the Modified gear dimension input screen in Fig. 2.4. The pinion will be completely in contact with the gear at the flank area shown in red but, in blue area, there is a clearance of 50-μm from the tooth flank of the mating gear. The user can change the pinion rotation angle in the control form to see how the contact area moves. Fig. 2.14a and Fig. 2.14b show contact area of spiral bevel and zerol pinions, respectively.



X axis angle: -30
Y axis angle: 34
Z axis angle: -16
Z axis movement: 3390
Pinion rotation angle: 7.3372

Fig. 2.14 Tooth Contact Area (Straight Bevel)

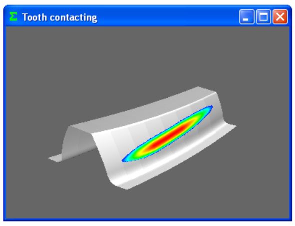


Fig. 2.14a Tooth Contact Area (Spiral)

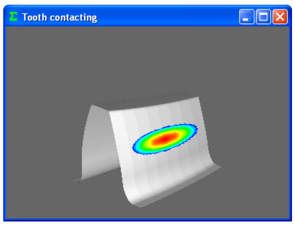
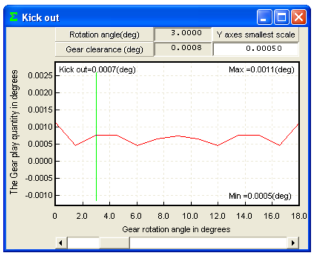


Fig. 2.14b Tooth Contact Area (Zerol)

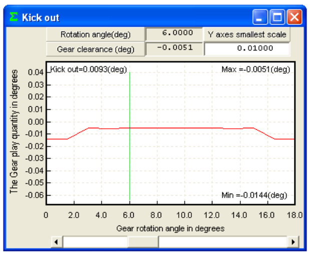
2.12 Kick Out Graph

The Kick Out feature simulates the circumferential play ("kick out") in the gear from the start to the end of meshing with the pinion. As shown in Fig. 2.15, the kick out value is only "0.0007" degree when the gearshaft mounting error is 0. However, changing both the horizontal and vertical errors in gear shaft mounting to 5μm in Fig. 2.10 will increase the kick out value to "0.0093" degree as shown in Fig. 2.16, significantly changing the kick-out curve.



Rotation angle(deg): 3.0000
Gear clearance (deg): 0.0008
Y axes smallest scale: 0.00050

Fig. 2.15 Kick Out Graph 1

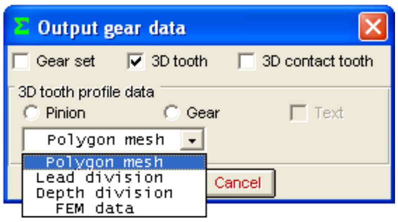


Rotation angle(deg): 6.0000
Gear clearance (deg): -0.0051
Y axes smallest scale: 0.01000

Fig. 2.16 Kick Out Graph 2

2.13 Tooth Profile Data Output

As shown in Fig. 2.17, the user can choose to output the assembly drawing, 3D tooth profile, or 3D meshing tooth profile image into a data file. Fig. 2.18 is an example of a 3D pinion tooth profile output file displayed in a CAD system. Fig. 2.19 is an example of 3D meshing tooth profile image output for FEM analysis, where the tooth profile data will be output into separate files for the left/right flank and tip portions.



☐ Gear set ☑ 3D tooth ☐ 3D contact tooth
3D tooth profile data
○ Pinion ○ Gear ☐ Text
Polygon mesh

Fig. 2.17 Tooth Profile Data File Output

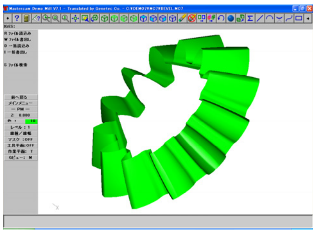


Fig. 2.18 3D Pinion Tooth Profile (IGES)

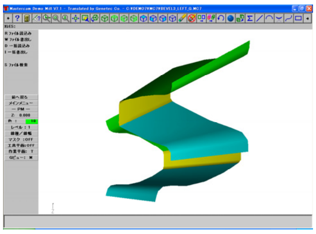


Fig. 2.19 3D Meshing Tooth Profile (IGES)

2.14 Gear Strength Calculation

(1) Torque Unit Setting (N･m, N･cm, kgf･m, kgf･cm, gf･cm)

Fig. 2.20 shows the Torque unit tab of the Initial strength calculation settings screen.

☑ Metal gear strength
Torque unit: ○ N m ● N cm ○ kgf m ○ kgf cm
☐ Plastic gear strength
Torque unit: ● N cm ○ kgf cm ○ gf cm

Fig. 2.20 Initial Strength Calculation Settings Screen (Torque Unit Tab)

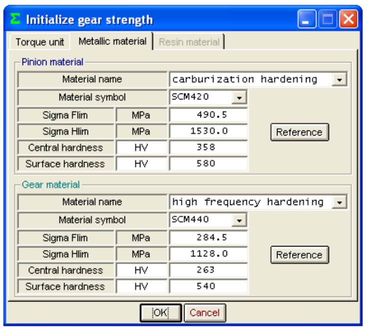
(2) Bevel Gear Strength Calculation

The System calculates the strength of metal gears based on the JGMA 403-01 and 404-01 standards. For resin gears, the calculation of the bending strength is based on the Lewis formula and the strength of the tooth flank on the Hertzian stress.

(3) Materials

Fig. 2.21 shows the Metal material tab of the Initial Strength Calculation Settings screen. The stress values shown in the Resin material tab are experimental values taking into account the temperature and life cycle of the resin material.

The applicable materials are M90, KT20, and GH25. The characteristics of other material can be calculated based on M90.



Pinion material

Material name		carburization hardening
Material symbol		SCM420
Sigma Flim	MPa	490.5
Sigma Hlim	MPa	1530.0
Central hardness	HV	358
Surface hardness	HV	580

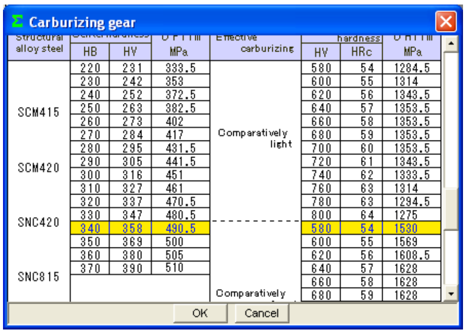
Gear material

Material name		high frequency hardening
Material symbol		SCM440
Sigma Flim	MPa	284.5
Sigma Hlim	MPa	1128.0
Central hardness	HV	263
Surface hardness	HV	540

Fig. 2.21 Initial Strength Calculation Settings Screen (Metal material Tab)

(4) Material Selection

Clicking the [Reference] button in Fig. 2.21 displays the material selection screen as shown in Fig. 2.22. On this screen, the user can determine the allowable stress value for the material based on the hardness values shown in the list. The material symbol and the allowable stress ($ó_{Flim}$, $ó_{Hlim}$) and hardness values can be specified directly on the Metal material tab.

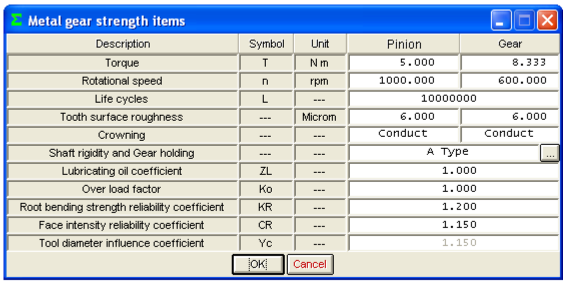


Structural alloy steel				Effective carburizing	hardness		
	HB	HV	MPa		HV	HRc	MPa
	220	231	333.5		580	54	1284.5
	230	242	353		600	55	1314
	240	252	372.5		620	56	1343.5
SCM415	250	263	382.5		640	57	1353.5
	260	273	402		660	58	1353.5
	270	284	417	Comparatively light	680	59	1353.5
	280	295	431.5		700	60	1353.5
SCM420	290	305	441.5		720	61	1343.5
	300	316	451		740	62	1333.5
	310	327	461		760	63	1314
	320	337	470.5		780	63	1294.5
	330	347	480.5		800	64	1275
SNC420	340	358	490.5		580	54	1530
	350	369	500		600	55	1569
	360	380	505		620	56	1608.5
	370	390	510		640	57	1628
SNC815					660	58	1628
				Comparatively	680	59	1628

Fig. 2.22 Material Selection (Reference Screen)

(5) Strength Setting (Dynamic)

Fig. 2.23 shows the metal strength setting screen, on which the user can specify the input torque, speed, and other data.

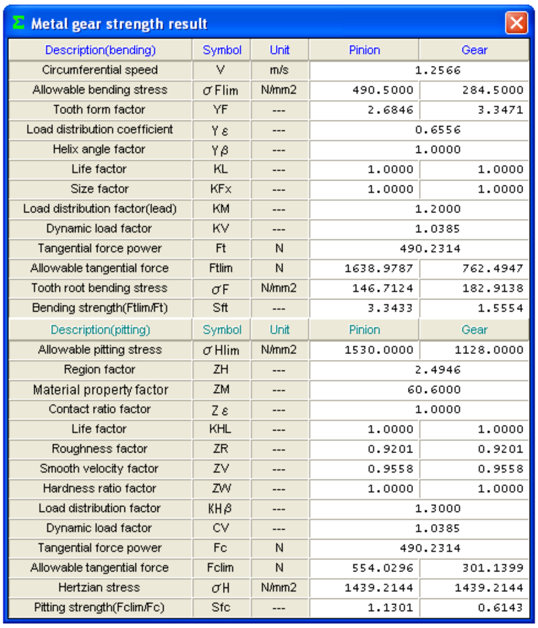


Description	Symbol	Unit	Pinion	Gear
Torque	T	N m	5.000	8.333
Rotational speed	n	rpm	1000.000	600.000
Life cycles	L	---	10000000	
Tooth surface roughness	---	Microm	6.000	6.000
Crowning	---	---	Conduct	Conduct
Shaft rigidity and Gear holding	---	---	A Type	
Lubricating oil coefficient	ZL	---	1.000	
Over load factor	Ko	---	1.000	
Root bending strength reliability coefficient	KR	---	1.200	
Face intensity reliability coefficient	CR	---	1.150	
Tool diameter influence coefficient	Yc	---	1.150	

Fig. 2.23 Dynamic Strength Setting

(6) Strength Calculation Result

Fig. 2.24 shows the Metal gear strength calculation result screen.

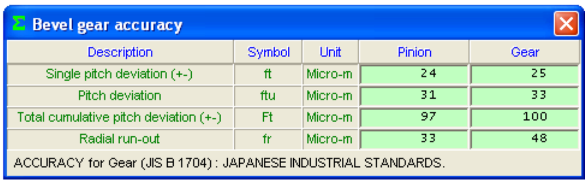


Description(bending)	Symbol	Unit	Pinion	Gear
Circumferential speed	V	m/s	1.2566	
Allowable bending stress	σFlim	N/mm2	490.5000	284.5000
Tooth form factor	YF	---	2.6846	3.3471
Load distribution coefficient	Yε	---	0.6556	
Helix angle factor	Yβ	---	1.0000	
Life factor	KL	---	1.0000	1.0000
Size factor	KFx	---	1.0000	1.0000
Load distribution factor(lead)	KM	---	1.2000	
Dynamic load factor	KV	---	1.0385	
Tangential force power	Ft	N	490.2314	
Allowable tangential force	Ftlim	N	1638.9787	762.4947
Tooth root bending stress	σF	N/mm2	146.7124	182.9138
Bending strength(Ftlim/Ft)	Sft	---	3.3433	1.5554
Description(pitting)	**Symbol**	**Unit**	**Pinion**	**Gear**
Allowable pitting stress	σHlim	N/mm2	1530.0000	1128.0000
Region factor	ZH	---	2.4946	
Material property factor	ZM	---	60.6000	
Contact ratio factor	Zε	---	1.0000	
Life factor	KHL	---	1.0000	1.0000
Roughness factor	ZR	---	0.9201	0.9201
Smooth velocity factor	ZV	---	0.9558	0.9558
Hardness ratio factor	ZW	---	1.0000	1.0000
Load distribution factor	KHβ	---	1.3000	
Dynamic load factor	CV	---	1.0385	
Tangential force power	Fc	N	490.2314	
Allowable tangential force	Fclim	N	554.0296	301.1399
Hertzian stress	σH	N/mm2	1439.2144	1439.2144
Pitting strength(Fclim/Fc)	Sfc	---	1.1301	0.6143

Fig. 2.24 Metal Gear Strength Calculation Result Screen

2.15 Gear Accuracy

Fig. 2.25 shows the error tolerance for bevel gears as per the JIS B 1704 standard.



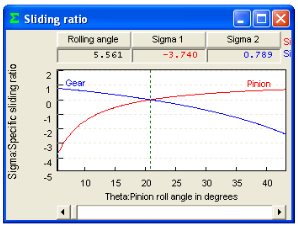
Description	Symbol	Unit	Pinion	Gear
Single pitch deviation (+-)	ft	Micro-m	24	25
Pitch deviation	ftu	Micro-m	31	33
Total cumulative pitch deviation (+-)	Ft	Micro-m	97	100
Radial run-out	fr	Micro-m	33	48

ACCURACY for Gear (JIS B 1704) : JAPANESE INDUSTRIAL STANDARDS.

Fig. 2.25 Gear Accuracy

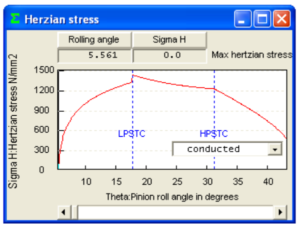
2.16 Sliding Ratio and Hertzian Stress Graphs

Fig. 2.26 and Fig. 2.27 show the sliding ratio and Hertzian stress graphs for a bevel gear pair, respectively.



Rolling angle	Sigma 1	Sigma 2
5.561	-3.740	0.789

Fig. 2.26 Slipping Ratio Graph



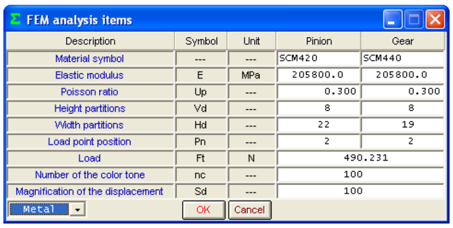
Rolling angle	Sigma H
5.561	0.0

Fig. 2.27 Hertzian Stress Graph

2.17 FEM Tooth Profile Stress Analysis

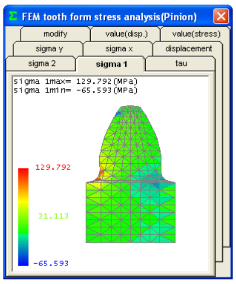
Stress analysis can be easily performed by simply clicking the [FEM] button after the strength calculation. Fig. 2.28 shows the FEM analysis setting screen. The user may change the Young modulus, Poisson ratio, number of partitions, and load values.

This System supports five types of stresses ($ó_x$, $ó_y$, shear stress ô, and principal stresses $ó_1$, $ó_2$). The reliability of a gear pair can be improved by calculating the gear strength and then evaluating the actual stress on the tooth flanks. Fig. 2.29 and Fig. 2.30 show the equivalent stress curves for the maximum ($ó_1$) and minimum ($ó_2$) principal stresses, respectively.



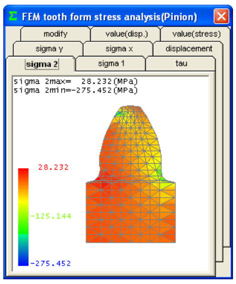
Description	Symbol	Unit	Pinion	Gear
Material symbol	---	---	SCM420	SCM440
Elastic modulus	E	MPa	205800.0	205800.0
Poisson ratio	Up	---	0.300	0.300
Height partitions	Vd	---	8	8
Width partitions	Hd	---	22	19
Load point position	Pn	---	2	2
Load	Ft	N	490.231	
Number of the color tone	nc	---	100	
Magnification of the displacement	Sd	---	100	

Fig. 2.28 FEM Analysis Settings



```
sigma 1max= 129.792(MPa)
sigma 1min= -65.593(MPa)
```

Fig. 2.29 Maximum Principle Stress ($ó_1$)

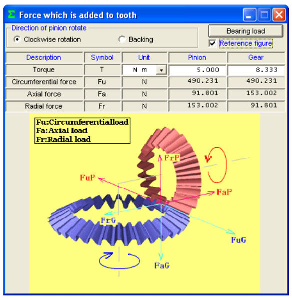


```
sigma 2max=  28.232(MPa)
sigma 2min=-275.452(MPa)
```

Fig. 2.30 Minimum Principle Stress ($ó_2$)

2.18 Bearing Load Calculation

The System calculates the loads exerted on both the gear and bearings.

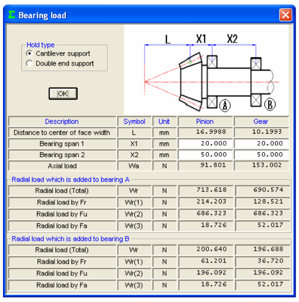


Direction of pinion rotate
● Clockwise rotation ○ Backing
☑ Reference figure

Description	Symbol	Unit	Pinion	Gear
Torque	T	N m	5.000	8.333
Circumferential force	Fu	N	490.231	490.231
Axial force	Fa	N	91.801	153.002
Radial force	Fr	N	153.002	91.801

Fu:Circumferentialload
Fa:Axial load
Fr:Radial load

Fig. 2.31 Loads on Gear Tooth Flanks



Hold type
● Cantilever support
○ Double end support

Description	Symbol	Unit	Pinion	Gear
Distance to center of face width	L	mm	16.9988	10.1993
Bearing span 1	X1	mm	20.000	20.000
Bearing span 2	X2	mm	50.000	50.000
Axial load	Wa	N	91.801	153.002
Radial load which is added to bearing A				
Radial load (Total)	Wr	N	713.618	690.574
Radial load by Fr	Wr(1)	N	214.203	128.521
Radial load by Fu	Wr(2)	N	686.323	686.323
Radial load by Fa	Wr(3)	N	18.726	52.017
Radial load which is added to bearing B				
Radial load (Total)	Wr	N	200.640	196.688
Radial load by Fr	Wr(1)	N	61.201	36.720
Radial load by Fu	Wr(2)	N	196.092	196.092
Radial load by Fa	Wr(3)	N	18.726	52.017

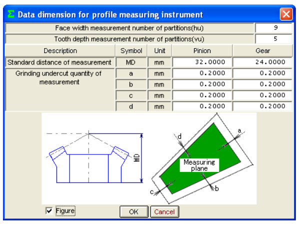
Fig. 2.32 Loads on Bearings

2.19 Tooth Profile Measurement

The System produces measurement data that can be used on either Zeiss 3D measuring systems or Osaka Seimitsu Kikai's measuring machines. Specify whichever you prefer when ordering the System.

(1) Outline of Measurement Data for Zeiss 3D Measuring Systems

Fig. 2.33 shows the setting screen for Zeiss 3D measuring systems. Specifying the number of partitions along with the relief amount and standard distance values for measurement causes the System to output the measurement point coordinates and vectors as shown in Fig. 2.34 into a data file.

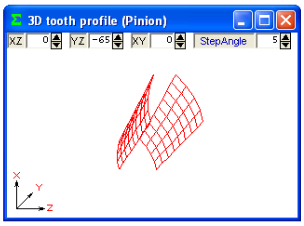


Data dimension for profile measuring instrument

Face width measurement number of partitions(hu)				9
Tooth depth measurement number of partitions(vu)				5
Description	Symbol	Unit	Pinion	Gear
Standard distance of measurement	MD	mm	32.0000	24.0000
Grinding undercut quantity of measurement	a	mm	0.2000	0.2000
	b	mm	0.2000	0.2000
	c	mm	0.2000	0.2000
	d	mm	0.2000	0.2000

☑ Figure

Fig. 2.33 Measurement Data Settings



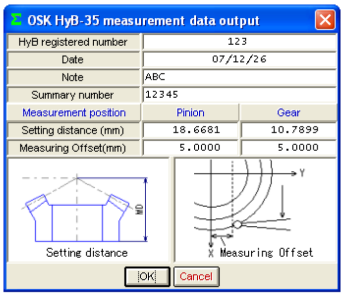
3D tooth profile (Pinion)

XZ 0 YZ -65 XY 0 StepAngle 5

Fig. 2.34 Generated Tooth Profile

(2) Outline of Measurement Data for Osaka Seimitsu Kikai Measuring Machines

Specifying the measuring data as shown in Fig. 2.35 causes the software to output the nominal measurement data into a data file. The manufacturer's catalog says that the measuring machines (HyB-35 and HyB-65) perform "linear" measurement, rather than "point-to-point" measurement, for precision measurement. Unlike the grid-point based measurement used in the 3D measuring systems, these machines linearly measure up to the edge of each tooth to detect subtle profile errors for improved gear accuracy.



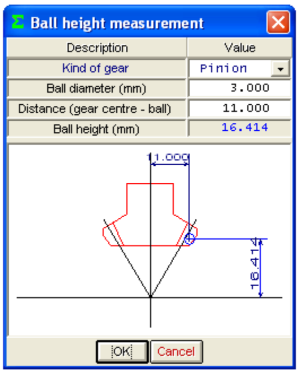
OSK HyB-35 measurement data output

HyB registered number	123	
Date	07/12/26	
Note	ABC	
Summary number	12345	
Measurement position	Pinion	Gear
Setting distance (mm)	18.6681	10.7899
Measuring Offset(mm)	5.0000	5.0000

Fig.2.35 Measurement Data Settings

2.20 Ball Height Measurement

Ball height measurement is a technique to control the tooth thickness of a gear, in which the measurement is made with respect to the ball placed around the center of the gear face width. This technique is suitable for controlling the gear tooth thickness in the manufacturing phase. Fig. 2.36 shows how the ball height of a bevel gear is measured.



Ball height measurement

Description	Value
Kind of gear	Pinion
Ball diameter (mm)	3.000
Distance (gear centre - ball)	11.000
Ball height (mm)	16.414

Fig. 2.36 Ball Height Measurement

2.21 Manufacturing Examples

Fig. 2.37 is an example of a gear set machined using an NC ball-end milling machine with tooth profile data generated by this System. (The tooth profile data was imported into a CAD/CAM system before loading into the NC machine). Fig. 2.38 is a photograph of a photofabricated gear model.

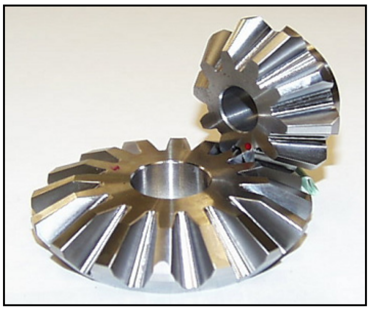


Fig. 2.37 Example of Machined Gear Pair

Fig. 2.38 Photo fabricated Gear Model (m1, NT28, α20°, β35°)