### How to model High Ratio Hypoid gear set in 3d CAD

With help of Microsoft Excel and Spiralbevel.com Microsoft Excel - High ratio Hypoid\_5\_04\_17\_DEVELOPMENT.xls
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			nput Amount of normal to un thekness contect in		
			tipt Amount of to i dirregion		
4 56 49			Input coefficient of tool correction	-0.2000000	
5			Gear toe addendum	3.7994860	
6 54			Gear Heel addendum	4.3574734	
7			Pinion heel dedendum	5.1766254	
8			Pinion toe dedendum	4.6186381	
9 50			Pinion toe addendum	2.4580012	
10			Gear Toe dedendum	3.2771533	
11 55			radial clearacne normal to gear pitch cone	0.8191520	
12 30 -			Gear heel dedendum	4.9143672	
13			Pinion circular space without backlash	-4.8076170	
14 FAVA 50 VAVAVAVA			Pinion circular backlash	0.5504984	
15			Suggested Amount of normal tooth thickness corr	2.3140525	
1620			Suggested Amount of tool correction	2.7933085	
49			Suggested Cefficient of tool correction	0.6820000	
18			Gear coefficient of dedendum	1.0000000	
19 STEP 1: Input:	1		Gear circle normal tooth thickness	-1.4982937	
20 GEAR MEAN PITCH DIAMETER:	200.000		Gear circulat tooth thickness	-1.8290788	
21 RATIO ([PINION RPM] / [GEAR RPM]):	20.000		Suggested Pinion coefficient of addendum	1.6820000	
22 HYPOID OFFSET	60.000		Gear/pinion circular pitch	15,7079633	
23 HAND OF SPIRAL ON GEAR (LEFT OR RIGHT):	RIGHT		epsilon	0.6399262 36.66507291	
24 LINITS (MM or INCH)	MM	Calculation progress [%]	Tetta	0 0217920 1 248590998	
25 CALCULATION ACCURACY [1.2.3 N]	4	11	0 Tetta shtrikh	0.0217920 1.248589583	
26			Coefficient of hynoid offset	0.3000000	
20 27 STED 2: Input:		Suggestions:	apprict and a set	1.53/3125 87.909632016 STEP 3: Optional Input:	
		jouggeanona.	year pitch angle	1.5545125 07.505052010 <b>31CF 5. 0710101 input.</b>	_
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28 NUMBER OF TEETH ON PINION:	2	6	Gear mean circular module	5.0000000 Remove some profile points from root	+
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28       NUMBER OF TEETH ON PINION:         29       NUMBER OF TEETH ON GEAR:         30       GEAR FACE WIDTH:         31       PRESSURE ANGLE [DEG]:         32       GEAR MEAN SPIRAL ANGLE [DEG]:         33       PINION COEFFICIENT OF ADDENDUATION MEAN SPIRAL ANGLE [DEG]:         34       COEFFICIENT OF ADDENDUATION MEAN SPIRAL ANGLE SP	2 40 22.5 35 <b>atio</b> el.ccc 26.28436 3.51553 1.04972 200.00000 0.02000	6 120 40.95760 22.50000 35.00000 Hypoid m to ge 26.28436 3.51553 1.04972 260.00000 0.02005	Gear mean circular module Mean normal module Gear mean addendum Gear mean cone distance Gear addendum angle Gear addendum angle Gear mod angle Gear mod angle Gear mod angle Gear min cone distance Pinion axial face width Half pinion angular tooth thickness Half gear angular tooth thickness Half gear angular tooth thickness	5.0000000 4.0957602 4.0957602 100.0665903 0.0139488 0.799206168 0.799206168 0.799206168 0.799206168 0.799206168 0.7955602 1.5555667345 80.0665903 50.9725343 0.7595602 43.52074168 0.0395136 1.362976246 0.0992628 1.576534683	
28       NUMBER OF TEETH ON PINION:         29       NUMBER OF TEETH ON GEAR:         30       GEAR FACE WIDTH:         31       PRESSURE ANGLE [DEG]:         32       GEAR MEAN SPIRAL ANGLE [DEG]:         33       PINION COEFFICENT OF ADDENDUATION MEAN SPIRAL ANGLE [DEG]:         34       COEFFICIENT OF ADDENDUATION MEAN SPIRAL ANGLE SPONDARY         36       NORMAL MEAN TERMOVER OF ADDENDUATION MEAN FRANCISCULAR TO THE SPONDARY         37       GEAR FACE ANGLE         38       GEAR FACE ANGLE         39       PINION MEAN PITCH DIAMETER         40       PINION MEAN PITCH DIAMETER         41       PINION ROOT ANGLE         42       FACE CUTTER GENERATING DIAMETER.         43       PROFILE CROWNING:         44       LEAD CROWNING:         44       LEAD CROWNING:	2 40 22.5 35 <b>atio</b> el.ccc 26.28436 3.51553 1.04972 200.00000 0.02864 0.02864	6 120 40.95760 22.50000 35.00000 <b>Hypoid</b> <b>Dm to ge</b> 26.28436 3.51553 1.04972 200.00000 0.02005 0.02864	Gear mean circular module Mean normal module Gear mean addendum Gear mean cone distance Gear addendum angle Gardedenoum angle Gardedenoum angle Gear mod angle Gear mod angle Gear mod angle Gear min cone distance Pinion axial face width Half pinion angular tooth thickness Half gear angular tooth thickness Half gear angular tooth thickness Half gear angular tooth thickness Half gear angular tooth thickness	5.0000000 Remove some profile points from root 4.0957602 4.0957602 100.0665903 0.0139488 0.799206168 0.0139488 0.799206168 0.0139488 0.799206168 0.0253667345 0.0253667345 0.0665903 50.9725343 0.7595802 43.52074168 0.0395136 1.332376246 0.0292628 1.676634683 23.9075980	
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28       NUMBER OF TEETH ON PINION:         29       NUMBER OF TEETH ON GEAR:         30       GEAR FACE WIDTH:         31       PRESSURE ANGLE [DEG]:         32       GEAR MEAN SPIRAL ANGLE [DEG]:         33       PINION COEF         34       COEFFICIENT         35       PINION MEAN         36       NORMAL MEAN         37       GEAR FACE ANGLE         38       GEAR FACE ANGLE         39       PINION MEAN         30       DORMAL MEAN         31       GEAR FACE ANGLE         32       GEAR ROOT, ANGLE         34       COEFFICIENT OF DIAMETER         35       PINION MEAN         36       NORMAL MEAN         37       GEAR ROOT, ANGLE         39       PINION FACE ANGLE         40       PINION FACE ANGLE         41       PINION ROOT ANGLE         42       FACE CUTTER GENERATING DIAMETER.         43       PROFILE CROWNING:         44       LEAD CROWNING:         45       % FROM TOE TO MEAN POINT OF CONTACT [0,1]         47       MEAN         48       OUTPUEL         49       OUTPUEL	2 40 40 22.5 35 <b>atio</b> <b>el.cc</b> 26.2843 3 51553 1 0.4972 200.0000 0.02065 0.02864 0.40000 0.50000	6 120 40.95760 22.50000 35.00000 <b>Hyppoid</b> 00 10 10 10 26.2646 3.51553 1.04972 200.00000 0.02005 0.02864 0.40000 0.50000	Gear mean circular module Mean normal module Gear mean addendum Gear mean cone distance Gear addendum angle Gear root angle Contemporation of the second second Gear root angle Contemporation of the second second second Gear min cone distance Gear min cone distance Gear min cone distance Pinion angular tooth thickness Half gear angular tooth thickness Pinion axial from mean to heel Mean clearance Pinion mean addendum Pinion mean dedendum	5.0000000 Remove some profile points from root 4.0957602 4.0957602 100.0665903 0.0139488 0.799206168 0.0139488 0.799206168 0.0139488 0.799206168 0.0139488 0.799206168 0.0139488 0.799206168 0.0292628 43.52074168 0.0395136 1.362976246 0.0292628 1.676634683 23.9076800 0.8191520 3.2769082 3.2749207 4.9149123 40.1739746	

Excel file generates one surface for each gear tooth flank and three surfaces for each pinion tooth flank.



#### SolidWorks 2008 example.

## Why Excel?

- Easy to use. Reduce training cost.
- No installation cost.
- No approval required from IT department.
- Customize your own interface.
- Add you own formulas.
- Change to your preferred language.
- Easy to copy and give it to a friend to evaluate.
- Simple way to store digital master gear. Excel generates exactly the same digital master for the same input data.

#### Why spiralbevel.com

1. No gear experience needed. Just start entering what you know and the program will recommend the remaining gear data.

STEP 1: Input:		
GEAR MEAN PITCH DIAMETER:	200.000	
RATIO ([PINION RPM] / [GEAR RPM]):	20.000	
HYPOID OFFSET	60.000	
HAND OF SPIRAL ON GEAR (LEFT OR RIGHT):	RIGHT	
UNITS (MM or INCH)	ММ	Calculation progress [%]
CALCULATION ACCURACY [1,2,3,,N]	4	100
STEP 2: Input:	$\frown$	Suggestions:
NUMBER OF TEETH ON PINION:	2	6
NUMBER OF TEETH ON GEAR:	40	120
GEAR FACE WIDTH:	40	40.95760
PRESSURE ANGLE [DEG]:	22.5	22.50000
GEAR MEAN SPIRAL ANGLE [DEG]:	35	35.00000

Variety of the outputs provides more freedom to optimize the root for minimum stress.

> 2. Accurate calculation of the root undercut. Excel delivers 3 surfaces for each flank:

UNDERCUT

- Entire flank including the undercut
- Flank without undercut
- Undercut only

# 4. Nominal data file is used for CMM inspection of spiral bevel and hypoid gears.

It is also used as a master gear to derive original gear machine summary if gear needs to be cut on a gear generating machine such as Gleason or Klingelnberg.

🖉 Testjob_Ge.txt - Notepa	d				x
<u>F</u> ile <u>E</u> dit F <u>o</u> rmat <u>V</u> iew	/ <u>H</u> elp				
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* * DATE: 4/19/2016	TIME: 1	10:21:38 AM	UNIT	* 5: mm * ******	
*јі х	Y Z	XN	YN	ZN *	
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{r} 85.4299 & -140.9152\\ 84.1785 & -138.4565\\ 82.9276 & -135.9978\\ 81.6771 & -133.5392\\ 80.4272 & -131.0805\\ 79.1777 & -128.6218\\ 77.9286 & -126.1631\\ 76.6801 & -123.7044\\ 75.4321 & -121.2457\\ 77.8309 & -139.6469\\ 76.6046 & -137.4909\\ 76.6046 & -137.4909\\ 76.3788 & -134.7490\\ 74.1533 & -132.3000\\ 72.9283 & -129.8510\\ 71.7037 & -127.4021\\ 70.4796 & -124.9531\\ 69.2558 & -122.5042\\ 68.0325 & -120.0552\\ 70.5464 & -138.3786\\ 69.3441 & -135.9393\\ 68.1421 & -133.5001\\ 66.9405 & -131.0609\\ \end{array}$	$\begin{array}{c} -0.\ 6599\\ -0.\ 6584\\ -0.\ 6576\\ -0.\ 6576\\ -0.\ 6542\\ -0.\ 6528\\ -0.\ 6528\\ -0.\ 6429\\ -0.\ 6449\\ -0.\ 6429\\ -0.\ 6445\\ -0.\ 6429\\ -0.\ 6415\\ -0.\ 6387\\ -0.\ 6337\\ -0.\ 6335\\ -0.\ 6331\\ -0.\ 6317\\ -0.\ 6258\\ -0.\ 6226\\ -0.\ 6226\\ -0.\ 62216\\ \end{array}$	0.5953 0.5970 0.6005 0.6022 0.6039 0.6056 0.6073 0.6089 0.6155 0.6171 0.6187 0.6203 0.6220 0.6236 0.6252 0.6267 0.6283 0.6348 0.6348 0.6379 0.6394	0.4585 0.4583 0.4579 0.4576 0.4576 0.4576 0.4570 0.4570 0.4550 0.4557 0.4557 0.4554 0.4552 0.4554 0.4554 0.4554 0.4554 0.4548 0.4548 0.45443 0.4541 0.4522 0.4525	

5. Easy tooth contact pattern development. Just enter amount of crowning on lead and profile with the relevant position of the center of the contact. The program automatically generates an ideal tooth contact for quietest roll and highest endurance.

58	GEAK KUUT ANGLE	11.59592497	(1.59592
39	PINION MEAN PITCH DIAMETER	44.13987	44.13987
10	PINION FACE ANGLE	11.95598	11.95598
11	PINION ROOT ANGLE	6.43115	6.43115
12	FACE CUTTER GENERATING DIAMETER:	200.000	200.00000
13	PROFILE CROWNING:	0	0.02005
14 <mark>.</mark>	LEAD CROWNING:	0	0.02864
<b>1</b> 5	% FROM TOE TO MEAN POINT OF CONTACT [0,1]	0.4	0.40000
<del>16</del>	% FROM GEAR TOOTH TIP TO MEAN POINT OF CONTACT [0,	0.4	0.50000
17			
18	Output:	GEAR	PINION
19	OUTSIDE DIAMETER	247.8220569	65.33893868

6. Communication with advanced Tooth Contact Analysis (TCA) program from spiralbevel.com for more detailed TCA

#### such as VH and $\boldsymbol{\alpha}$ in 3d animation.



7. Tooth geometry calculation formulas provided if needed for study and customization for each unique project

Radial clearance coeffitient		0.2500000	1.170217206	
Input Amount of hormal tooth thickness	correction	0.8730900		
Input Amount of tool correction		0.3351738		
Input coefficient or tool contention		2000000		
Casa Maaladdaa dura		4 510 700		
Dision keel dedendum		4.0130103 E.CO000		
Pinion heel dedendut		0.6636363		
Pinion toe dedendom		4.1240030		
Pinion toe adden um		9.0336222		
clear toe deder dum		11700170		
radial clearacte normal to gear pitch con-	·	0.0044000		
Dision size or choose without backlack		6.36440UZ		
Pinion circular space without backlash		0.2034421		
Suggester Amount of normal tooth thick		2 9772269	- <b>\</b>	
Suggested Amount of horizontation	ness cone	2.3112363	- <b>\</b>	
Sugges and Amount of tool correction		0.6920000	- <b>\</b>	
Suggested Cerriclent of confection		0.6620000	- <b>\</b>	
Gear treas permait booth thickness		0.0000000	<b>\</b>	
Gear and Fhom a coord the		3.3420473	- L	
Sugnation Division configuration of a data data	<b>.</b>	16920000	<b>1</b>	
Get Ininion coemclent or addendu		17 9519500	<b>t</b>	
er lon		0.2642906	15 1404662	
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25 Nean normal module		4 6000600		veniove some pr
930 Pear mean addendum		3 7446951		
50000 Gear mean cope distance	1	01 1276599		
00000 Dear addendum angle		0.0332901	1907390732	
18200 Dear face angle		33 34 29971	4775 201985	
25000 Dear mean dedendum	`	6 7872598	4110.201000	
42888 Dear dedendum angle		0.0670153	3 839691391	
15549 Gear root angle	7	7.5959250		
34300 E bion mean spiral angle		50.4851891	0.881132773	
59592 G ar max cone distance	12	4.6276599		
13987 Gar min cone distance	7	7.6276599		
35598 Pi ion axial face width	4	8.3870093		
43115 Hall pinion angular tooth thickness		0.2815795	16,1333149	
.00000 Hall gear angular tooth thickness		0.0404418	1.41546395	
02005				
02864 Pinion pitch cone angle		0.1442457	8.264668082	
\$0000 Pinice axial from mean to heel	2	3.9578596		
50000 Mean clearance		1.1702172		
Pinion nean addendum		5.6170426	5.6053 94	
Pinion a ean dedendum		4.9149123		
Pinion mean cone distance	18	53.5342801		
Pinion may cone distance	17	7.7435623		
From gear wis to pinion mean along pinio	n axis 9	6.2860322		
Pinion heel ddendum		7.1942630		
Pinion addenuum angle		0.0644256 🍢	3 91313036	
Pinion min cone distance	12	28.8487619		
Pinion Dedendung angle		0.0320009 🍢	1.833516246	
From pinion axis gear apex		7.0099347 🮽		
From pinion apex to gear axis	5	5.653735		
From gear axis to pining toe	7	71.85689.5		
Generating gear min controlistance		64.741 265		
Generating gear face width	10	221785		
Generating gear max cone disc ace		2.1639051	170.2441303	
From gear axis to pinion heel	12	20.2438919		
Cutter radial distance	9	2.8758044		
Cutter radius reduction on addendum		1.5825765		

 Accurate high resolution UNDERCUT modeling for Finite Element Analysis (FEA). The undercut is generated by the generating wheel exactly as it is generated on gear generating machines a.k.a. Gleason or Klingelnberg.



9. Easy to machine ring gear tooth. No need 5 axis. Can be machined by a form cutter in one pass due to constant cross section of the tooth slot. This method is also known as FORMATE per Gleason.



10. Comparable with any CAD software. Excel generates 3d surface file in iges protocol that is used in any CAD/CAM



