NX modeling of 3-d tooth contact pattern on spiral bevel gear with spiralbevel.com software.

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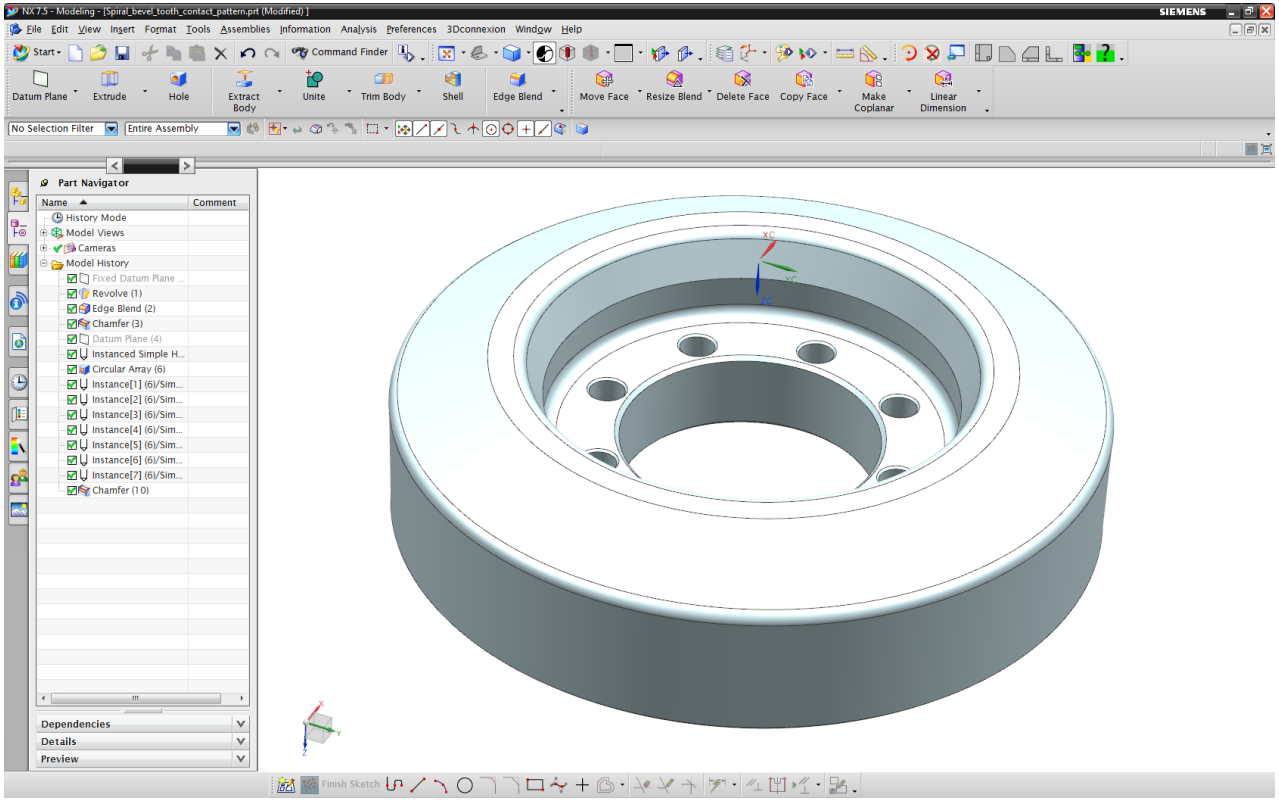
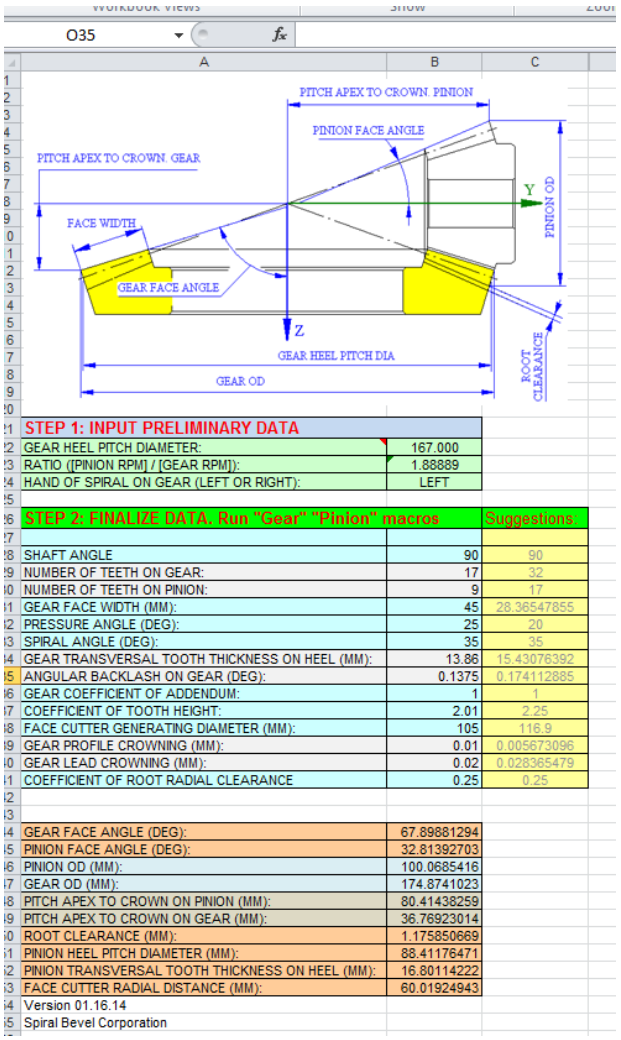
January 2014

1. Model gear blank



2. Input gear tooth data into Spiral Bevel Excel program



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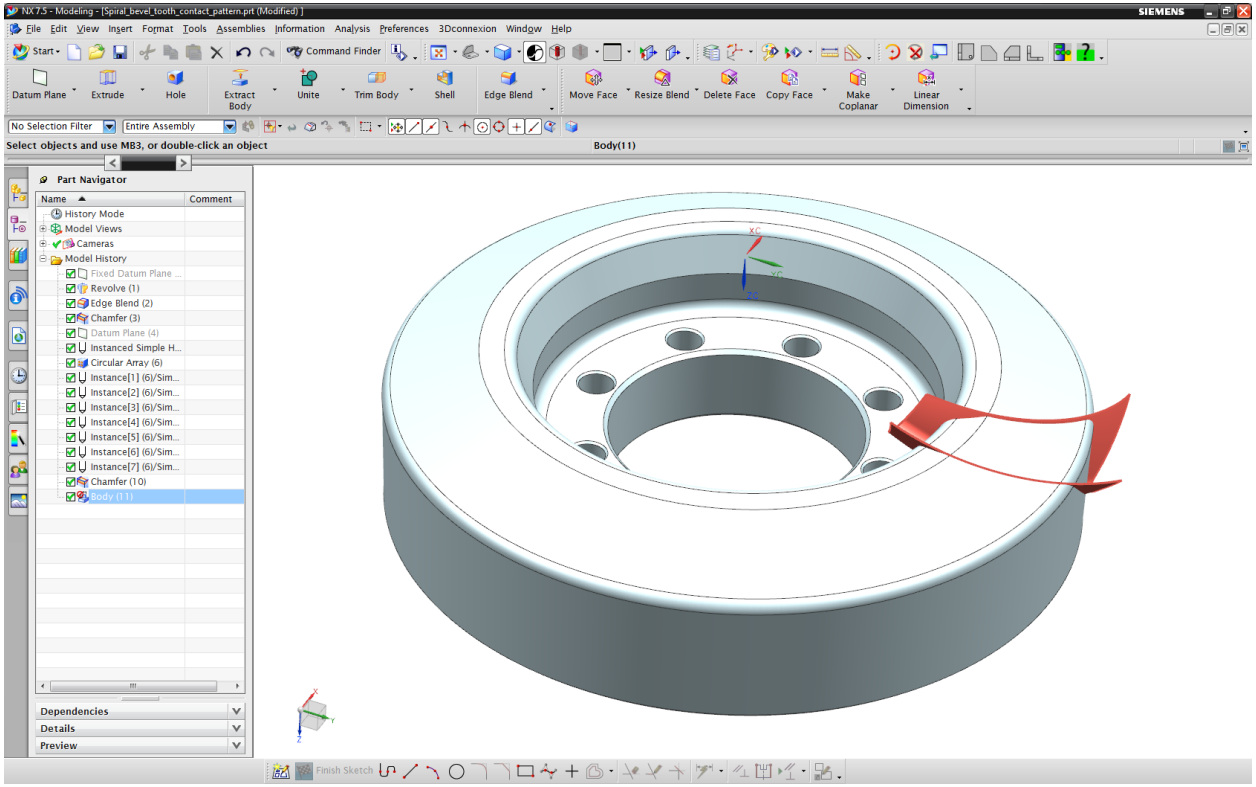
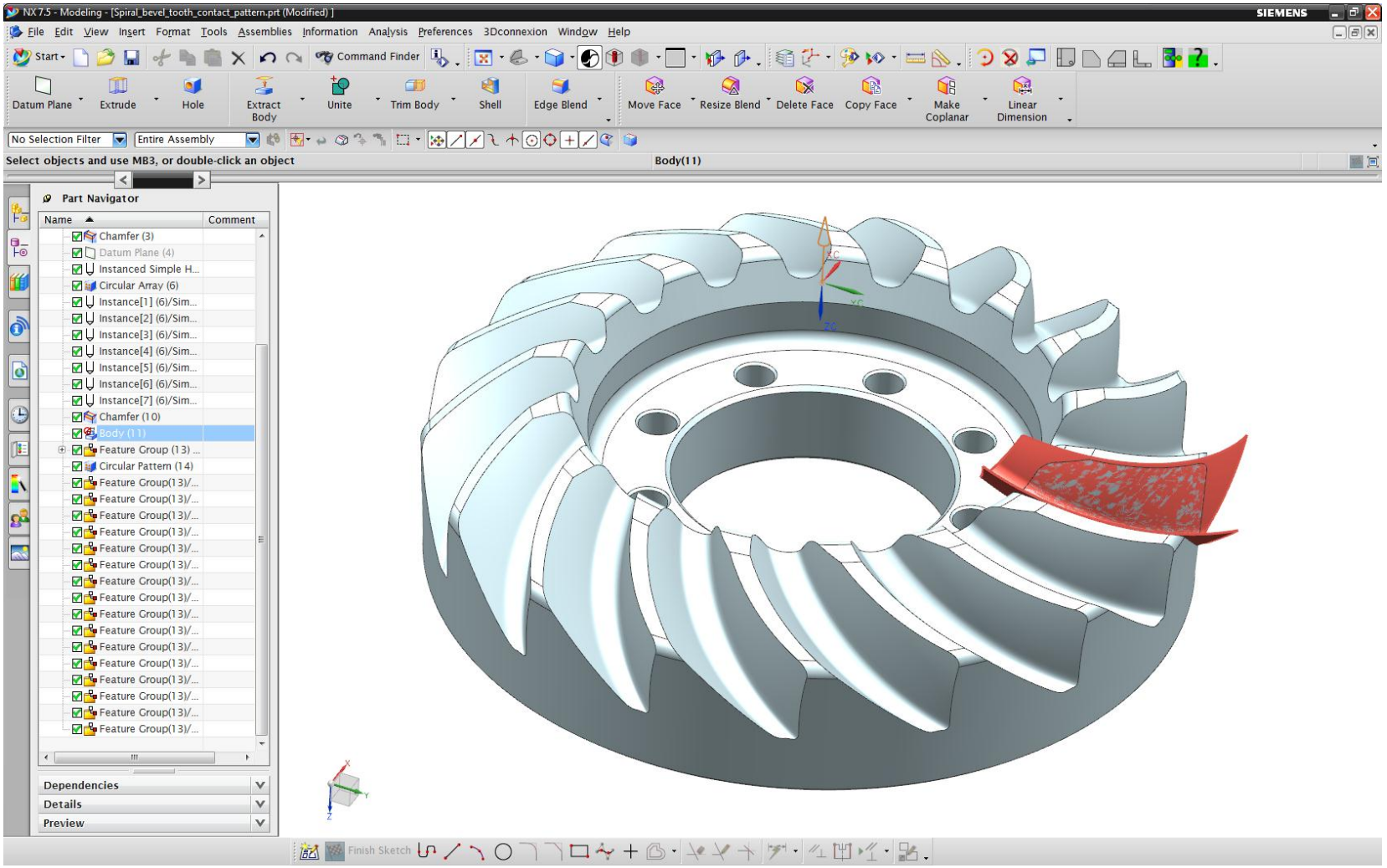
STEP 1: INPUT PRELIMINARY DATA		
GEAR HEEL PITCH DIAMETER:	167.000	
RATIO ([PINION RPM] / [GEAR RPM]):	1.88889	
HAND OF SPIRAL ON GEAR (LEFT OR RIGHT):	LEFT	
STEP 2: FINALIZE DATA. Run "Gear" "Pinion" macros		Suggestions:
SHAFT ANGLE	90	90
NUMBER OF TEETH ON GEAR:	17	32
NUMBER OF TEETH ON PINION:	9	17
GEAR FACE WIDTH (MM):	45	28.36547855
PRESSURE ANGLE (DEG):	25	20
SPIRAL ANGLE (DEG):	35	35
GEAR TRANSVERSAL TOOTH THICKNESS ON HEEL (MM):	13.86	15.43076392
ANGULAR BACKLASH ON GEAR (DEG):	0.1375	0.174112885
GEAR COEFFICIENT OF ADDENDUM:	1	1
COEFFICIENT OF TOOTH HEIGHT:	2.01	2.25
FACE CUTTER GENERATING DIAMETER (MM):	105	116.9
GEAR PROFILE CROWNING (MM):	0.01	0.005673096
GEAR LEAD CROWNING (MM):	0.02	0.028365479
COEFFICIENT OF ROOT RADIAL CLEARANCE	0.25	0.25
GEAR FACE ANGLE (DEG):	67.89881294	
PINION FACE ANGLE (DEG):	32.81392703	
PINION OD (MM):	100.0685416	
GEAR OD (MM):	174.8741023	
PITCH APEX TO CROWN ON PINION (MM):	80.41438259	
PITCH APEX TO CROWN ON GEAR (MM):	36.76923014	
ROOT CLEARANCE (MM):	1.175850669	
PINION HEEL PITCH DIAMETER (MM):	88.41176471	
PINION TRANSVERSAL TOOTH THICKNESS ON HEEL (MM):	16.80114222	
FACE CUTTER RADIAL DISTANCE (MM):	60.01924943	
Version 01.16.14		
Spiral Bevel Corporation		

3. Run the gear macro in Excel and import the resulting iges tooth surface into NX



4. Cut teeth on the blank using “Trim Body” and other NX tools:



You have finished accurate 3d model of spiral bevel gear that can be used for CNC machining. Spiral Bevel Co used MS Excel to generate the surface that cuts teeth in NX or in any other CAD or CAM programs. Now we will use the same Excel program from Spiral Bevel Co in order to accurately simulate 3-dimensional tooth contact patter in NX. Tooth contact pattern is often checked in gear manufacturing by application of paint on the gear tooth and rolling the gear against the mating pinion on a rolling tester. The paint gets removed between the rolling areas of the tooth flanks so the color of the tooth contact is different from the remaining tooth area where paint remains.

We will do the same rolling of the gear against the mating pinion, but inside Spiral Bevel Excel program. Due to ingenuity of our algorithm the same macro can be used for rolling simulation. We just need to correct input data and the same macro will generate an envelope of the mating pinion in its rolling motion around our gear. In Spiral Bevel Excel program we need to:

- Reduce gear coefficient of tooth height for amount of coefficient of radial clearance
- Reduce gear tooth thickness for a small amount accordingly the size of grain of paint used in real production
- Remove lead and profile crowning assuming that mating pinion has no crowning

This way Spiral Bevel macro will generate a new gear tooth surface with radial clearance and small interference on both flanks. While it looks like a modified gear tooth surface it is, in fact, the envelope surface of the pinion rolling motion around the gear. The amount of interference should be about the size of the grains of pigment that is used in production to check the tooth contact so the 3d simulated tooth contact will be same size as the tooth contact in real life.

5. Make profile and lead crowning “0”. Reduce tooth height. Increase tooth thickness. Run the same macro but save under different name: “Pinion Envelope”.

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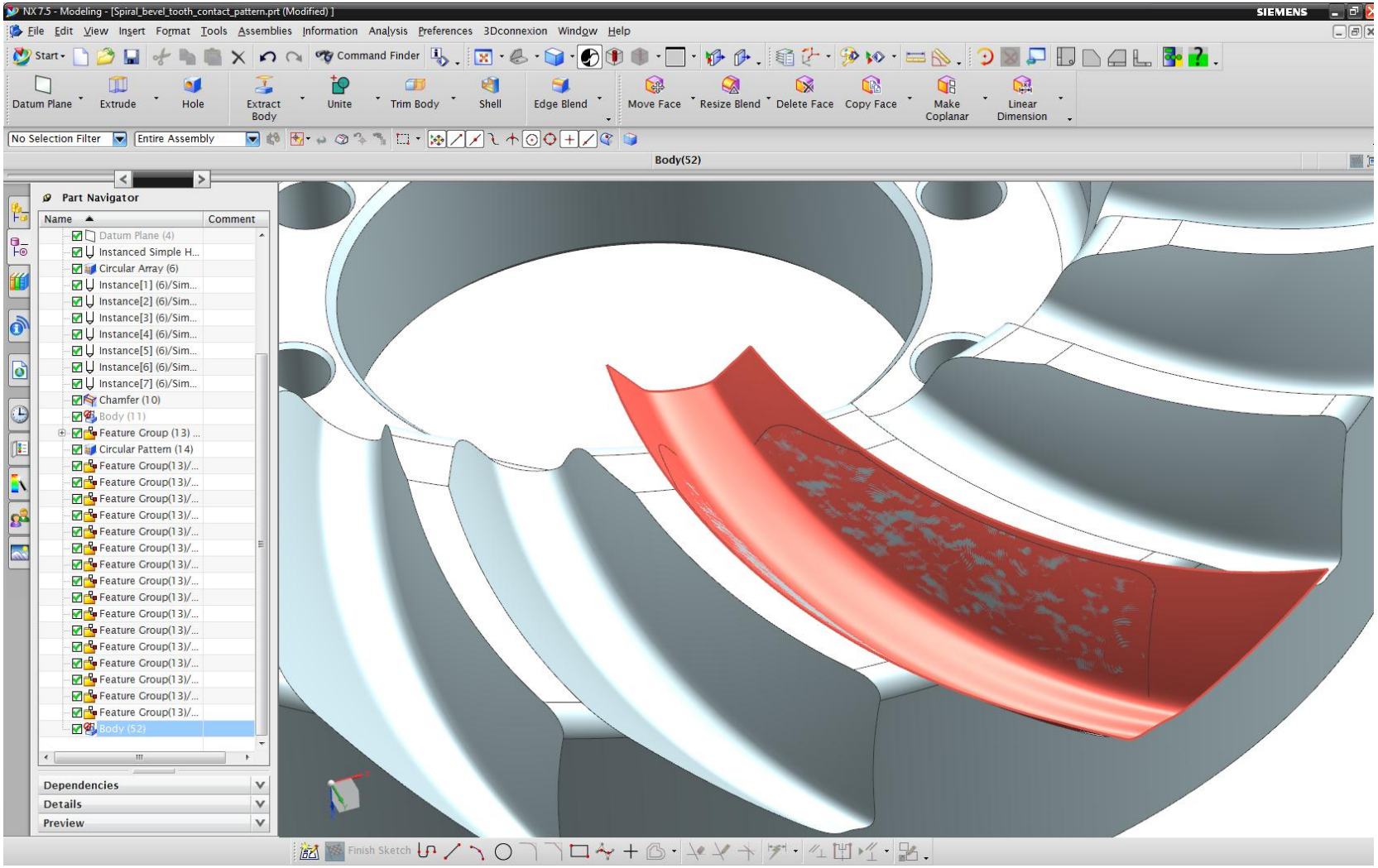
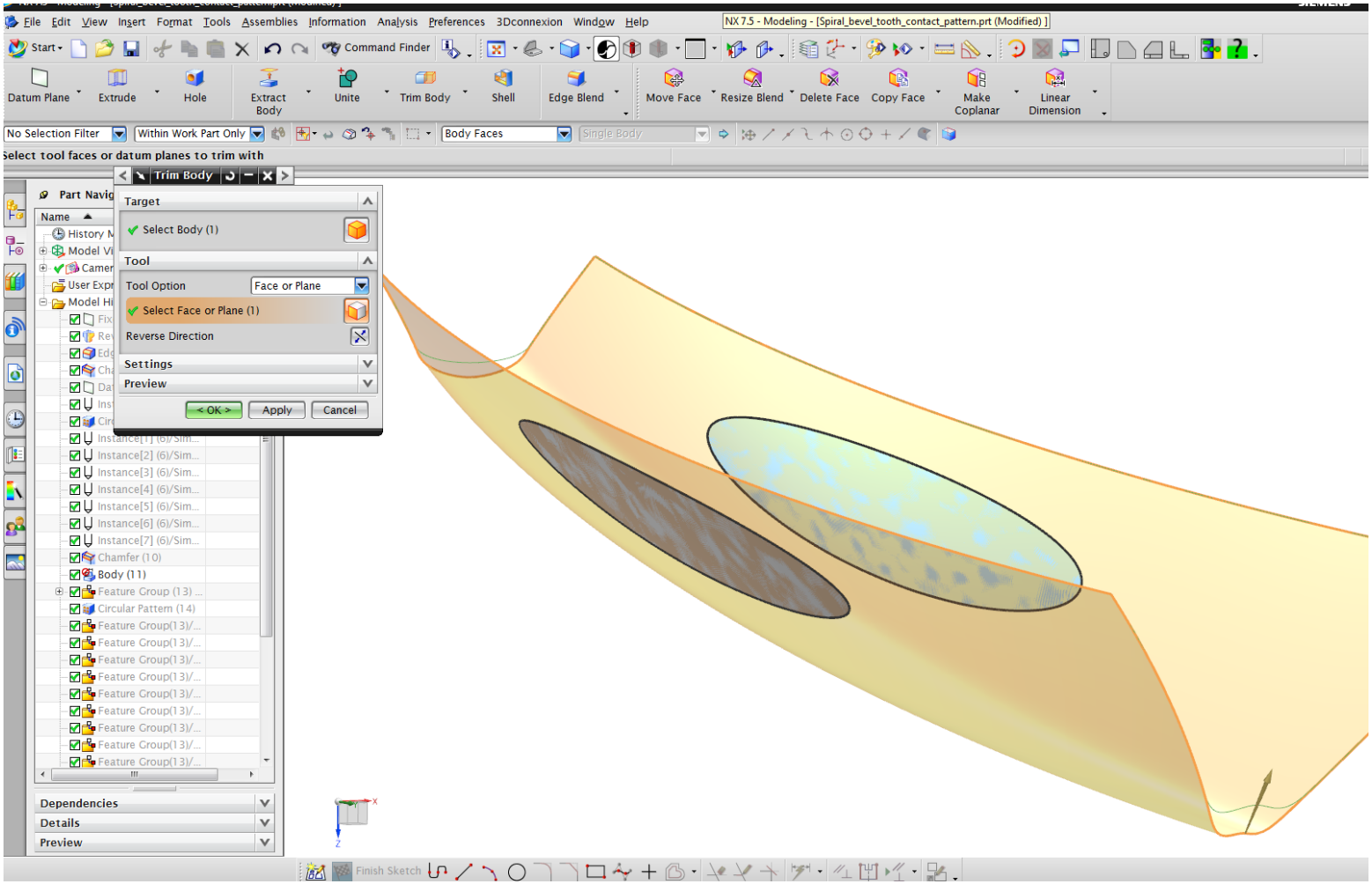
GEAR HEEL PITCH DIAMETER:	167.000	
RATIO ([PINION RPM] / [GEAR RPM]):	1.88889	
HAND OF SPIRAL ON GEAR (LEFT OR RIGHT):	LEFT	
STEP 2: FINALIZE DATA. Run "Gear" "Pinion" macros		Suggestions:
SHAFT ANGLE	90	90
NUMBER OF TEETH ON GEAR:	17	32
NUMBER OF TEETH ON PINION:	9	17
GEAR FACE WIDTH (MM):	45	28.36547855
PRESSURE ANGLE (DEG):	25	20
SPIRAL ANGLE (DEG):	35	35
GEAR TRANSVERSAL TOOTH THICKNESS ON HEEL (MM):	13.85	15.43076392
ANGULAR BACKLASH ON GEAR (DEG):	0.17	0.174112885
GEAR COEFFICIENT OF ADDENDUM:	1	1
COEFFICIENT OF TOOTH HEIGHT:	1.76	2.25
FACE CUTTER GENERATING DIAMETER (MM):	105	116.9
GEAR PROFILE CROWNING (MM):	0	0.005673096
GEAR LEAD CROWNING (MM):	0	0.028365479
COEFFICIENT OF ROOT RADIAL CLEARANCE	0.25	0.25
GEAR FACE ANGLE (DEG):	67.89881294	
PINION FACE ANGLE (DEG):	31.60087389	
PINION OD (MM):	96.51263672	
GEAR OD (MM):	174.8741023	
PITCH APEX TO CROWN ON PINION (MM):	81.35565152	
PITCH APEX TO CROWN ON GEAR (MM):	36.76923014	
ROOT CLEARANCE (MM):	1.175850669	
PINION HEEL PITCH DIAMETER (MM):	88.41176471	
PINION TRANSVERSAL TOOTH THICKNESS ON HEEL (MM):	16.76377835	
FACE CUTTER RADIAL DISTANCE (MM):	60.01924943	
Version 01.16.14		
Spiral Bevel Corporation		

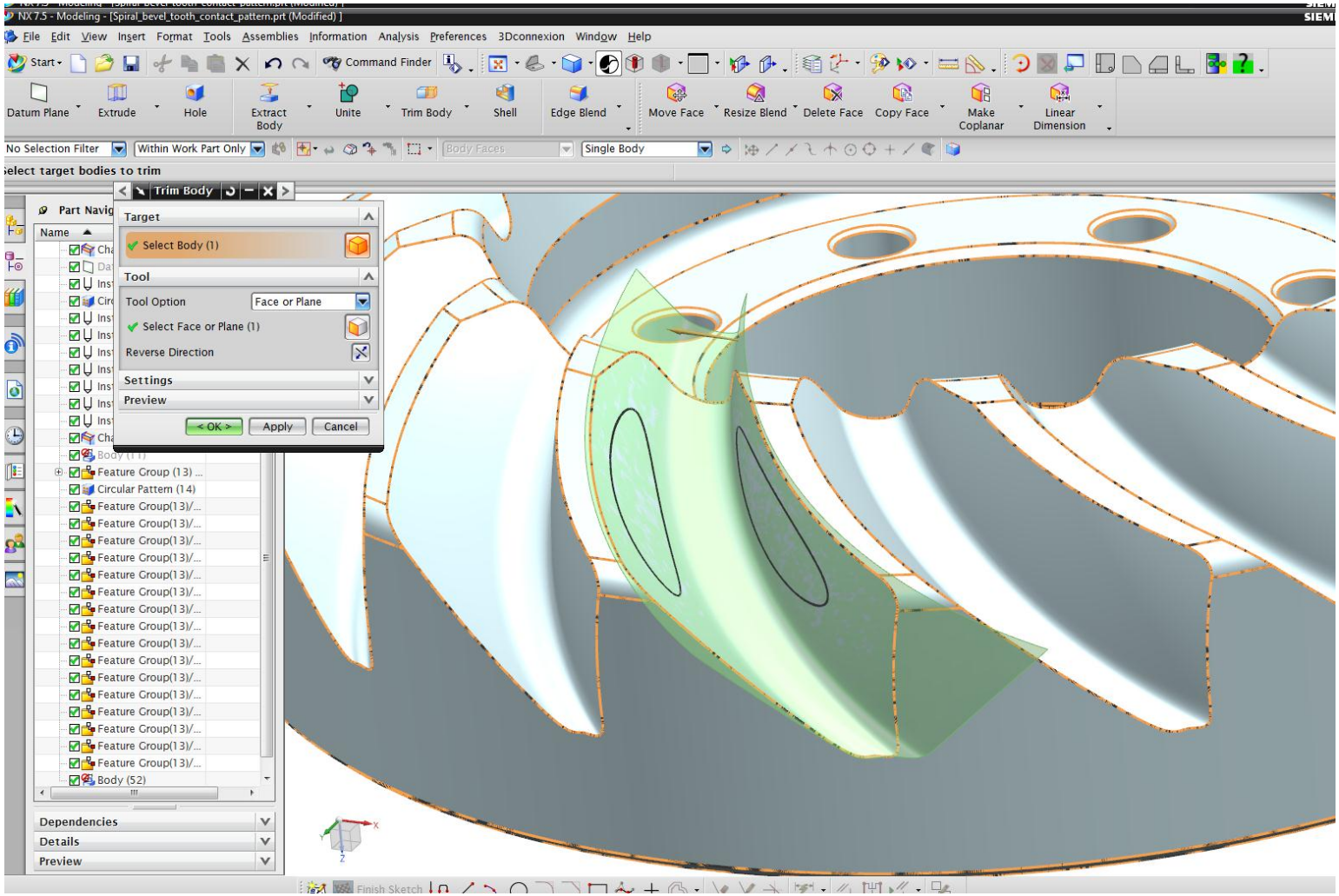
6. Import “Pinion Envelope” into 3d gear model:



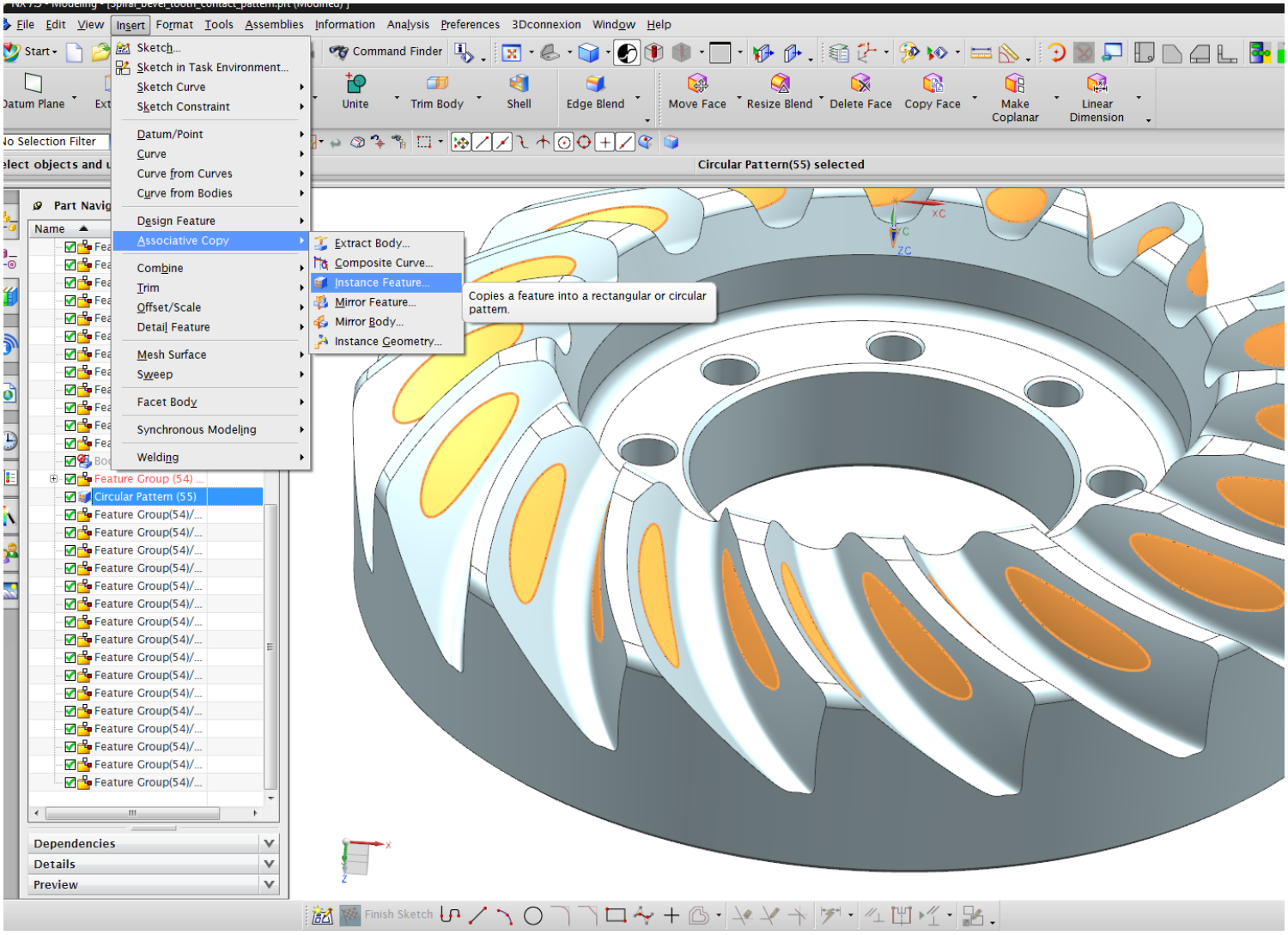
Now you have two very close overlapping surfaces. The intersection of two surfaces is the contact pattern that you need:



7. Use “Trim Body” to trim the gear with the new “Pinion Envelope” surface:

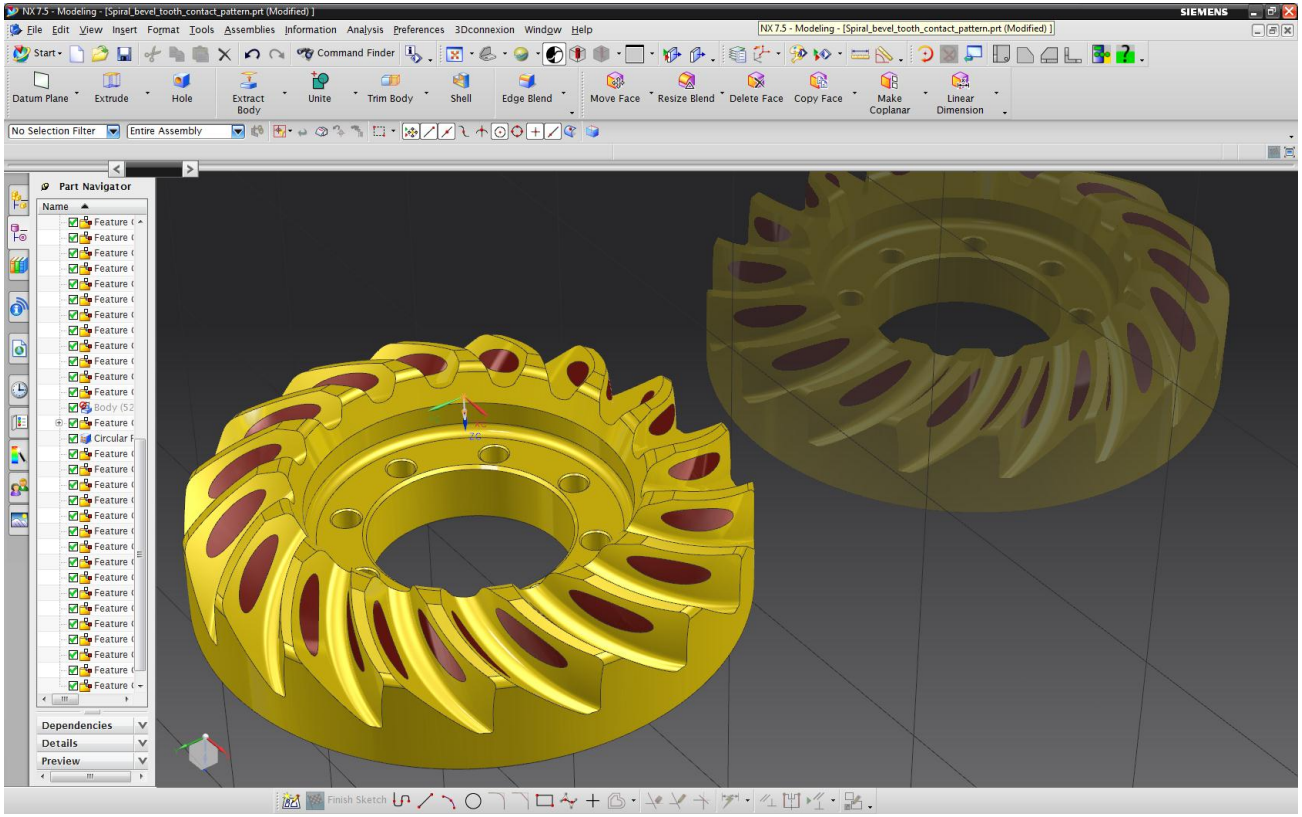


Do it on the remaining teeth with available NX tools:



Now you have both digital masters:

- 3 dimensional digital master gear
- 3 dimensional digital master contact pattern



There is always a better way to make gears

www.spiralbevel.com