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APPENDIX

Estimation and Validation of Highest Point Single Tooth Contact in Spur Gears using Spreadsheet Application

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Table S1. Depicts input parameters, its nomenclature, formula and Excel coding

Step 1: Calculation of basic parameters about Pitch Circle		
Circular pitch, *mm*	$p = \pi\, m = \frac{\pi\, d}{N}$	*=PI() *D8*
Pitch circle diameter of pinion, *mm*	$d_p = m * N_p$	*=D8*D5*
Pitch circle radius of pinion, *mm*	$r_p = \frac{d_p}{2}$	*=D14/2*
Pitch circle diameter of Gear, *mm*	$d_G = m * N_G$	*=D8*D6*
Pitch circle radius of Gear, *mm*	$r_G = \frac{d_G}{2}$	*=D16/2*
Step 2: Calculation of basic parameters about Addendum Circle		
Addendum, *mm*	$a = m$	*=D8*
Dedendum, *mm*	$b = 1.25 * m$	*=1.25*D8*
Addendum circle diameter of Pinion, *mm*	$d_{oP} = d_p + 2\, a = d_p + 2\, m$	*= D14+(2*D8)*
Addendum circle radius of Pinion, *mm*	$r_{oP} = \frac{d_{oP}}{2}$	*=D21/2*
Addendum circle diameter of Gear, *mm*	$d_{oG} = d_G + 2\, a = d_G + 2\, m$	*=D16+(2*D8)*
Addendum circle radius of Gear, *mm*	$r_{oG} = \frac{d_{oG}}{2}$	*=D23/2*
Step 3: Calculation of basic parameters about Base Circle		
Drive side base circle diameter of Pinion, *mm*	$d_{bP} = d_p \cos\emptyset_D$	*=D14*COS(D7*PI()/180)*
Drive side base circle radius of Pinion, *mm*	$r_{bP1} = \frac{d_{bP}}{2}$	*=D26/2*
Drive side base circle diameter of Gear, *mm*	$d_{bG} = d_G \cos\emptyset_D$	*=D16* COS(D7*PI()/180)*
Drive side base circle radius of Gear, *mm*	$r_{bG} = \frac{d_{bG}}{2}$	*=D28/2*
Step 4: Calculation of Contact Ratio		
Angle A, *degree*	$A = \cos^{-1}\left(\frac{d_{bG}}{d_{oG}}\right)$ **OR** $A = \cos^{-1}\left(\frac{N_G * \cos\emptyset}{d_{oG} * P}\right)$	*=(ACOS(D28/D23))*180/PI( )*
Angle β, *degree*	$\beta = \tan^{\wedge}(-1)[\tan\emptyset - [N\_G/N\_p * (\tan A - \tan\emptyset)]]$	*= (ATAN(TAN(D7*PI()/180) - ((D6/D5)*(TAN(D31 *PI()/180)-*

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		*TAN(D7*PI()/180)))))*180/PI()*
Angle α, *degree*	$\alpha = \cos^{-1}\left(\frac{d_{bP}}{d_{oP}}\right)$ ***OR*** $\alpha = \cos^{-1}\left(\frac{N_p * \cos\emptyset}{d_{oP} * P}\right)$	*=(ACOS(D26/D21))*180/PI()*
Angle B, *degree*	$B = \tan^{-1}\left\{\tan\emptyset - \left[\left(\frac{N_p}{N_G}\right) * (\tan\alpha - \tan\emptyset)\right]\right\}$	*=(ATAN(TAN(D7*PI()/180) - ((D5/D6)*(TAN(D33*PI()/180)-TAN(D7*PI()/180)))))*180/PI()*
Contact ratio m_f	$m_f = \frac{\sqrt{({r_{oG}}^2 - {r_{bG}}^2)} + \sqrt{({r_{oP}}^2 - {r_{bP}}^2)} - [(r_G + r_p)\sin\emptyset]}{p\cos\emptyset}$ *OR* $m_f = \frac{N_G}{2\,\pi}(\tan A - \tan B)$ *OR* $m_f = \frac{N_p}{2\,\pi}(\tan\alpha - \tan\beta)$	*=(D6/(2*PI()))*(TAN(D31*PI()/180)-TAN(D34*PI()/180))*
Step 5: Calculation of Contact Diameters / Contact Radius		
Contact diameter in Pinion, *mm*	$d_{cP} = \frac{d_p\cos\emptyset}{\cos\beta}$ ***OR*** $d_{cP} = \frac{N_p\cos\emptyset}{P\cos\beta}$	*=(D14*COS(D7*PI()/180))/COS(D32*PI()/180)*
Contact radius in Pinion, *mm*	$r_{cP} = \frac{d_{cP}}{2}$	*=D37/2*
diameter in Gear, *mm*	$d_{cG} = \frac{d_G\cos\emptyset}{\cos B}$ ***OR*** $d_{cG} = \frac{N_G\cos\emptyset}{P\cos B}$	*=(D16*COS(D7*PI()/180))/COS(D34*PI()/180)*
Contact radius in Gear, *mm*	$r_{cG} = \frac{d_{cG}}{2}$	*=D39/2*
Step 6: Calculation of LPSTC Diameters / LPSTC Radius		
Angle ε, *degree*	$\varepsilon = \tan^{-1}\left[\tan\alpha - \frac{2\,\pi}{N_p}\right]$	*=(ATAN(TAN(D33*PI()/180) -(2*PI()/D5)))*180/PI()*
LPSTC diameter in pinion, *mm*	$d_{LP} = \frac{d_p\cos\emptyset}{\cos\varepsilon}$ ***OR*** $d_{LP} = \frac{N_p\cos\emptyset}{P\cos\varepsilon}$	*=D14*COS(D7*PI()/180)/COS(D42*PI()/180)*
LPSTC radius in pinion, *mm*	$r_{LP} = \frac{d_{LP}}{2}$	*=D43/2*
Angle E, *degree*	$\mathrm{E} = \tan^{-1}\left[\tan A - \frac{2\,\pi}{N_G}\right]$	*=(ATAN(TAN(D31*PI()/180) -(2*PI()/D6)))*180/PI()*
LPSTC diameter in Gear, *mm*	$d_{LG} = \frac{d_G\cos\emptyset}{\cos\mathrm{E}}$ ***OR*** $d_{LG} = \frac{N_G\cos\emptyset}{P\cos\mathrm{E}}$	*=D16*COS(D7*PI()/180)/COS(D45*PI()/180)*
LPSTC radius in Gear, *mm*	$r_{LG} = \frac{d_{LG}}{2}$	*=D46/2*
Step 7: Calculation of HPSTC Diameters / HPSTC Radius		
Angle f, *degree*	$f = \tan^{-1}\left[\tan\beta - \frac{2\,\pi}{N_p}\right]$	*=(ATAN(TAN(D32*PI()/180) +(2*PI()/D5)))*180/PI()*
HPSTC diameter in pinion, *mm*	$d_{HP} = \frac{d_p\cos\emptyset}{\cos f}$ ***OR*** $d_{HG} = \frac{N_p\cos\emptyset}{P\cos f}$	*=D14*COS(D7*PI()/180)/COS(D49*PI()/180)*
HPSTC radius in pinion, *mm*	$r_{HP} = \frac{d_{HP}}{2}$	*=D50/2*
Angle F, *degree*	$F = \tan^{-1}\left[\tan B - \frac{2\,\pi}{N_G}\right]$	*=(ATAN(TAN(D34*PI()/180) +(2*PI()/D6)))*180/PI()*
HPSTC diameter in Gear, *mm*	$d_{HG} = \frac{d_G\cos\emptyset}{\cos F}$ ***OR*** $d_{HG} = \frac{N_G\cos\emptyset}{P\cos F}$	*=D16*COS(D7*PI()/180)/COS(D52*PI()/180)*
HPSTC radius in Gear, *mm*	$r_{HG} = \frac{d_{HG}}{2}$	*=D53/2*

Table S2. Calculation of Circular tooth thickness at LPSTC and HPSTC

Step 8: Circular tooth thickness at LPSTC	
Involute angle at pitch circle,	$\theta = \tan\phi - \phi$
Circular tooth thickness at pitch circle	$t_c = \frac{p}{2}$
Pressure angle at LPSTC in Pinion	$\phi_{LP} = cos^{-1}\left(\frac{d_{bP}}{d_{LP}}\right)$
Involute angle at LPSTC in Pinion	$\theta_{LP} = \tan\phi_{LP} - \phi_{LP}$
Circular tooth thickness at LPSTC in Pinion	$t_{cLP} = d_{LP} * \left(\frac{t_c}{d_p} + \theta - \theta_{LP}\right)$
Pressure angle at LPSTC in Gear	$\phi_{LG} = cos^{-1}\left(\frac{d_{bG}}{d_{LG}}\right)$
Involute angle at LPSTC in Gear,	$\theta_{LG} = \tan\phi_{LG} - \phi_{LG}$
Circular tooth thickness at LPSTC in Gear	$t_{cLG} = d_{LG} * \left(\frac{t_c}{d_G} + \theta - \theta_{LG}\right)$
Step 8: Circular tooth thickness at HPSTC	
Pressure angle at HPSTC in Pinion	$\phi_{HP} = cos^{-1}\left(\frac{d_{bP}}{d_{HP}}\right)$
Involute angle at HPSTC in Pinion	$\theta_{HP} = \tan\phi_{HP} - \phi_{HP}$
Circular tooth thickness at HPSTC in Pinion	$t_{cHP} = d_{HP} * \left(\frac{t_c}{d_p} + \theta - \theta_{HP}\right)$
Pressure angle at HPSTC in Gear	$\phi_{HG} = cos^{-1}\left(\frac{d_{bG}}{d_{HG}}\right)$
Involute angle at HPSTC in Gear	$\theta_{HG} = \tan\phi_{HG} - \phi_{HG}$
Circular tooth thickness at HPSTC in Gear	$t_{cHG} = d_{HG} * \left(\frac{t_c}{d_G} + \theta - \theta_{HG}\right)$

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