Spur Gear Contact Ratio and Interference Check

Contact ratio of a pair of standard spur gears from tooth numbers, module and pressure angle, and the minimum pinion teeth to avoid interference.

Method: Budynas and Nisbett; Shigley's Mechanical Engineering Design; ...

Input parameters

Unit system: SI

Parameter	Value	Unit
Pinion teeth	20.000	
Gear teeth	50.000	
Module	4.0000	mm
Pressure angle	20.002	°
Addendum coefficient (1 for full depth)	1.0000	

Calculated results

Parameter	Value	Unit
Centre distance	140.00	mm
Length of contact	19.551	mm
Contact ratio	1.6557	
Minimum pinion teeth to avoid interference	14.634	

Formula and method

$$L_c = \sqrt{(r_1 + a)^2 - r_{b1}^2} + \sqrt{(r_2 + a)^2 - r_{b2}^2} - C\sin\phi, \quad m_c = \frac{L_c}{\pi m \cos\phi}$$

Variables

z_1	Pinion teeth	-
z_2	Gear teeth	-
m	Module	m
ϕ	Pressure angle	rad
k_a	Addendum coefficient (1 for full depth)	-
C	Centre distance	m
L_c	Length of contact	m
m_c	Contact ratio	-
z_{min}	Minimum pinion teeth to avoid interference	-

Method and standards

Involute geometry.

Assumptions and limits

- Standard involute gears at standard centre distance.
- When interference occurs the contact length assumes full involute action, so the contact ratio is overstated.

References

• Budynas and Nisbett
• Shigley's Mechanical Engineering Design
• 10th ed. (McGraw-Hill, 2015)
• ch. 13 (contact ratio; interference)

Report details

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Release checks	2 reference cases of this calculator, computed independently, are checked on every release

Results are for engineering estimation. Verify critical designs against the referenced standards and your own data.

This calculator online

https://calc.firecad.com/mechanical/machine-design/gear-contact-ratio

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.