

# How to design a spur/crown gear set.

## THE QUESTION

**W**hen designing a spur/crown pair, is there a formula/guideline/design guide for adapting the spur teeth for the radial angle of the teeth in the crown?

Response provided by Chuck Schultz, P.E., (gearmanx52@gmail.com).

The beginning of wisdom, and this answer, is calling things by their proper name. While there is some standardization in terminology for the worldwide gear industry, “spur/crown pair” sent me to the Internet in hopes that this term had somehow eluded my vocabulary. Alas, Wikipedia did not settle the matter other than to assign the term “crown” to a face gear. We are aware of some engineers calling a bevel gear a “crown gear,” as well, so I will offer two separate answers to your question.

### ***If you meant a straight bevel gear set:***

Straight bevel gears mesh with intersecting shafts and can be made for right-angle and other angular configurations. The teeth in both members taper in cross-section—from outside diameter to inside edge. There are two commonly used “systems” for designing these gear sets: 1) the Gleason System employs a tapering tooth depth as well as tapering tooth thickness; 2) and the Klingelnberg system employs a constant tooth depth with a tapering tooth thickness.

Neither system has shown a power capacity advantage for equivalent designs.

Design guidance can be obtained from Gleason and Klingelnberg, who supply manufacturing equipment and cutting tools. Many gear reference books also discuss the design of straight bevel gear sets. You may also find *Gear Design Simplified*, by Franklin D. Jones and Henry H. Ryffel (Industrial Press, 1961, ISBN 978-0-83311-0209-8), helpful as well. I was pleased to learn this old reliable reference has been reprinted in paperback.

Diagrams for straight bevel gear sets can be found in *An Introduction to Gear Design*, which is available for free download at this author’s website — [www.beytagear.com](http://www.beytagear.com).

### ***If, on the other hand, you meant a face gear set:***

Face gear sets mesh with intersecting shafts and are generally made for right-angle configurations. Face gear sets use a conventional spur or helical pinion with *constant* cross-section teeth to drive a gear that has *tapered* cross-section teeth. The pinions are hobbled or ground; the gears are milled or shaped to match the pinion.

The design of these gears has never been standardized for larger gears. AGMA standard 203.03 — Fine Pitch On-center Face Gears for 20 Degree Involute Spur Pinions — has been withdrawn from the active files, but may contain the information you need. Darle Dudley’s *Gear Handbook* (McGraw-Hill, 1962, Library of Congress Catalog Card Number: 61-7304), devotes pages 5-71 through 5-74 to the design of face gears. This book should be considered an essential for any gear engineer’s library.

Diagrams for face gear sets can also be found in *An Introduction to Gear Design*, which is available for free download at this author’s website: [www.beytagear.com](http://www.beytagear.com).

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