For an involute spur gear set the tooth contact occurs along the straight line called the line of action.

A typical spur gear set has a contact ratio of $1.0 \leq m_p \leq 2.0$ and therefore, for the finite section along the line of action within the mesh cycle, only one pair of teeth is carrying the full load. The transition points where the contact shifts from one pair of teeth to two pairs are critical for gear strength calculations.

Lowest Point of Single Tooth Contact (LPSTC): The smallest diameter on a spur gear at which a single tooth of one gear is in contact with its mating gear. Gear's contact stress is calculated with the load applied at this point.

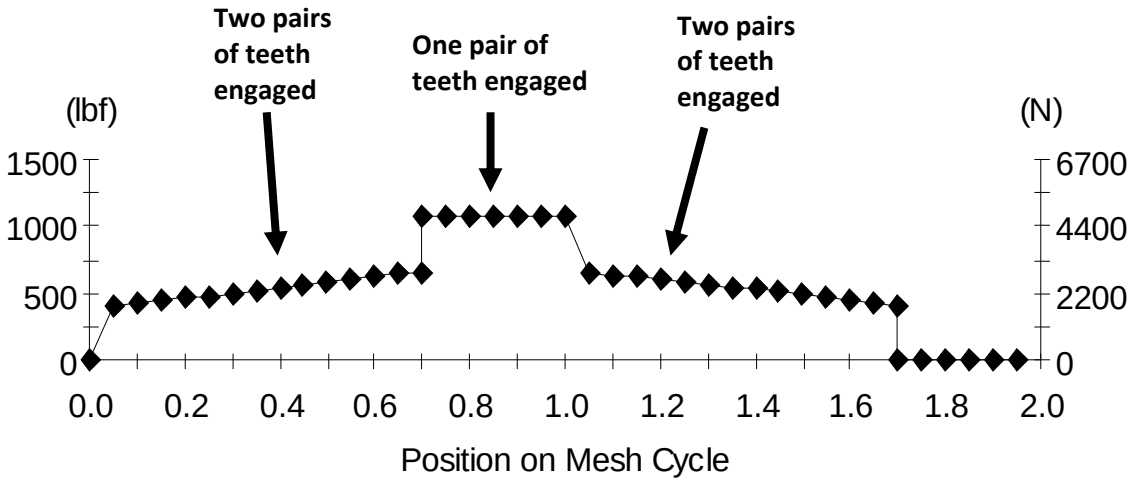
Highest Point of Single Tooth Contact (HPSTC): The largest diameter on a spur gear at which a single tooth is in contact with the mating gear. Gear's bending stress is determined with the load applied at this point.

Figures 1 to 4 illustrate the mesh cycle of a spur gear set.

In the first figure a driver pinion tooth 2, rotating in the direction indicated by the green arrow, is engaged with the driven gear tooth 1 (one pair of teeth in contact). Tooth 3 is approaching the line of action but is not engaged yet. Figure 2 illustrates an instant where the second pair of teeth (tooth 3 & tooth 4) comes into engagement. At this instant a point of contact between teeth 1 and 2 marks the location of the HPSTC for the pinion gear. From there, the mesh progresses with two pairs of teeth sharing the load as in Figure 3. In Figure 4 the tooth 1 and 2 pair is about to disengage and leave the line of action. For the pair of teeth 3 & 4 this point marks the LPSTC. A point contact (tooth 4 & tooth 3) progresses along the action line until another pair of teeth comes into engagement.

Figure 5 illustrates the relative distribution of gear force based on the position on a mesh cycle.

Figure 5 Tooth load distribution example



Theoretically these equations hold true (no center distance and major diameter tolerances):

LPSTC for Pinion = HPSTC for Gear

HPSTC for Pinion = LPSTC for Gear

For the actual gear strength calculations the LPSTC and HPSTC for the pinion and the gear differ. The compressive stress, in general, is calculated at the minimum center distance, maximum major diameters of the gears and no tooth tip chamfers. Bending stress, in general, is calculated at the maximum center distance, minimum major diameters and maximum tooth tip chamfer.

Figure 1: Single pair of teeth in contact

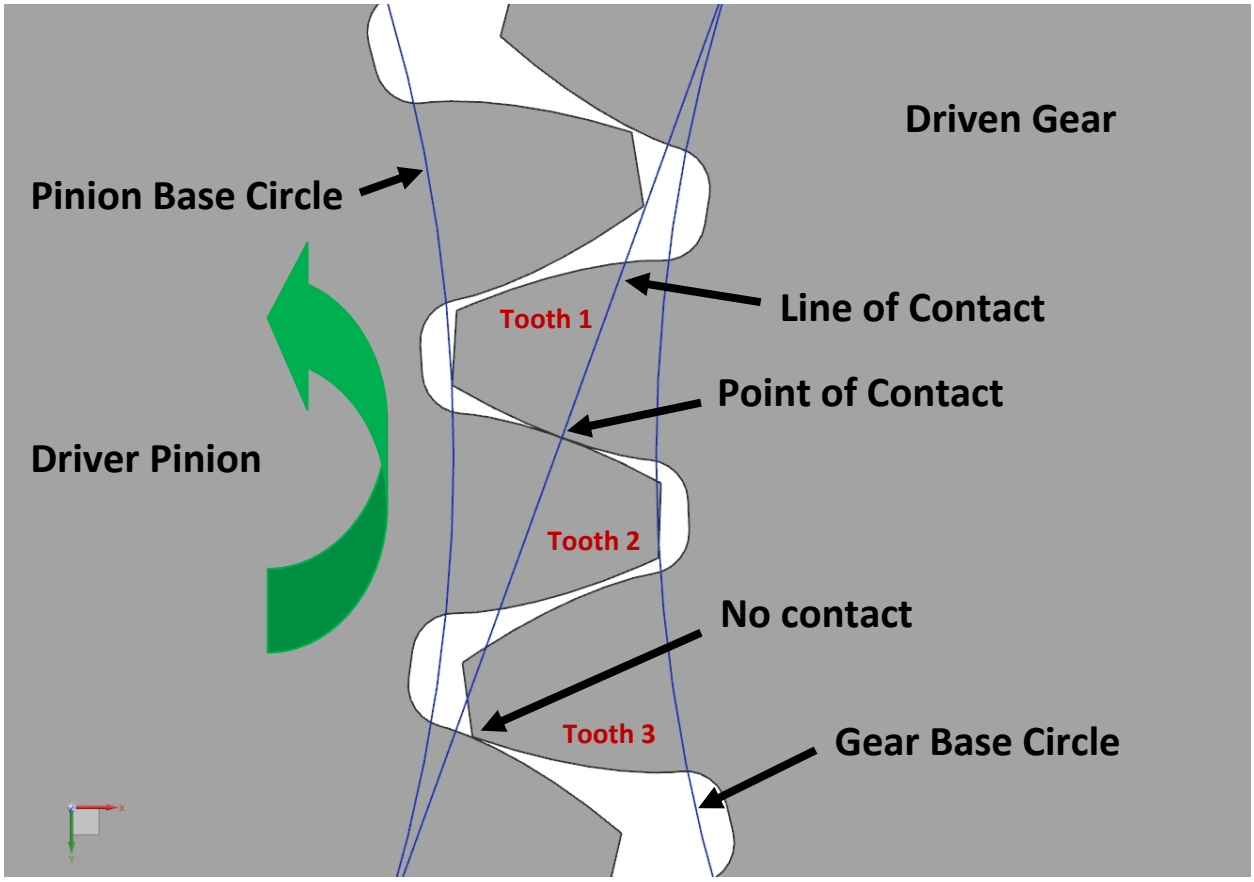


Figure 2: HPSTC – bending strength is calculated at this point

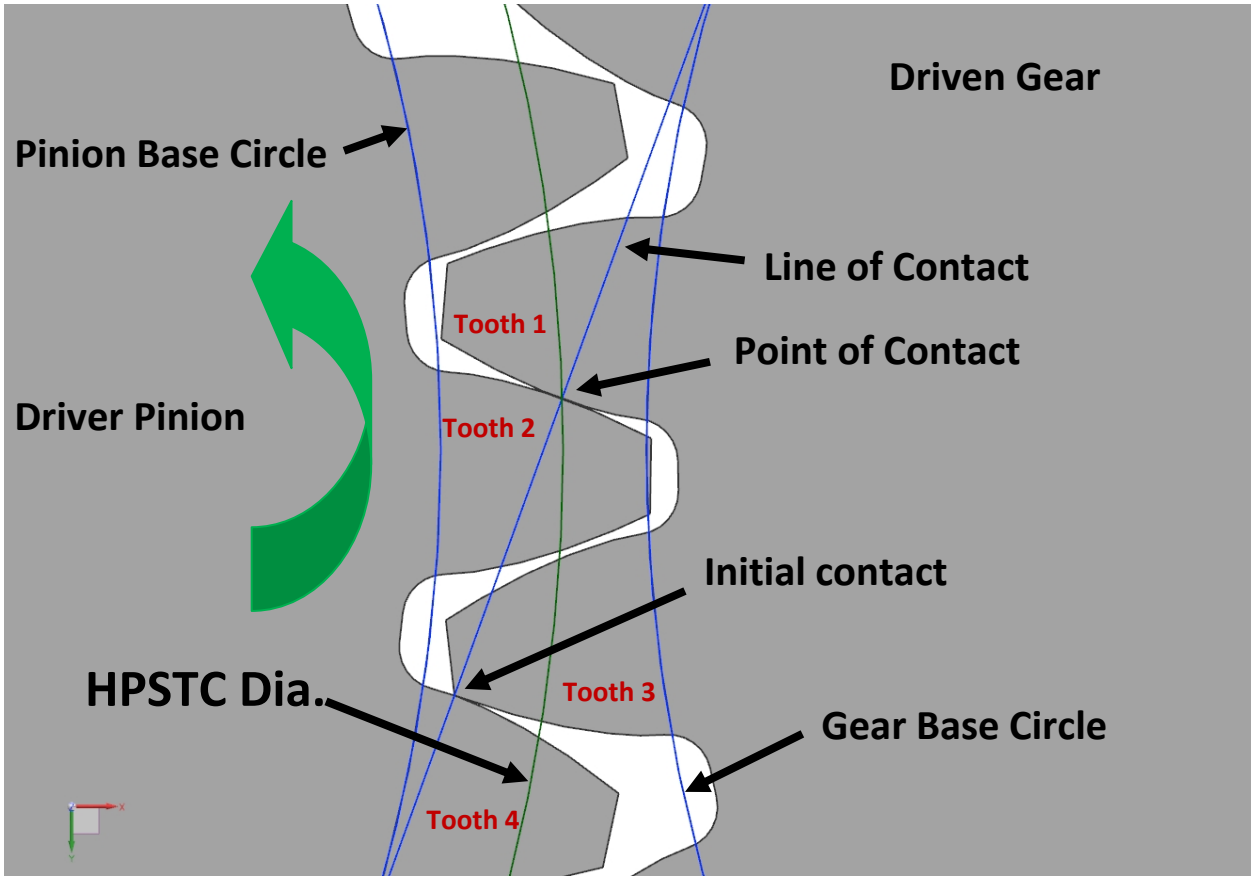


Figure 3: Two pairs of teeth in contact simultaneously

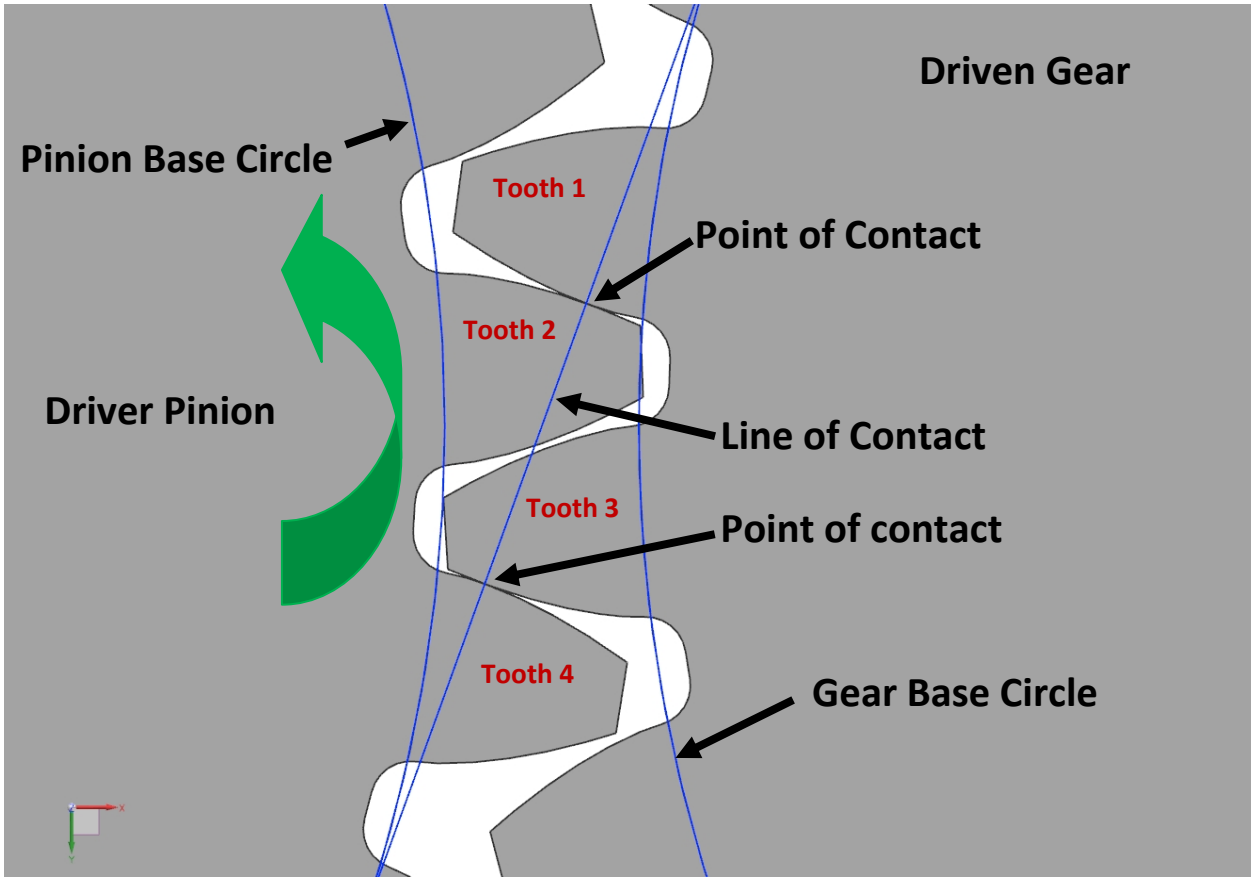


Figure 4: LPSTC Critical contact stress