E30 Semi-Trailing Arm Geometry

Camber and Toe Changes

The BMW E30 chassis is blessed with semi-trailing arms for the rear suspension layout. The word "blessed" is used somewhat facetiously in this case. The semi-trailing arm suspension is not particularly well regarded among race car builders as it has a reputation for bad camber and toe changes during movement of the rear wheels. There is some truth to this. A semi-trailing arm arrangement is usually used because it's compact layout allows a lot of room for other things, like passengers and luggage, not because it offers superior chassis dynamics. And it does display a lot of change in the alignment settings as it compresses or droops. Nonetheless, both the earlier Porsche 911 chassis' as well as the E30 BMW chassis' (and many others) have been developed into very competitive race cars while utilizing a semi-trailing arm rear suspension layout.

OK, so us E30 owners are stuck with the semi-trailing arms (for better or worse). Since that's what we're using, we might as well understand how it works. Exactly how much "does" the rear camber and toe change as you lower your car? Or as the rear wheels move up and down? I had always wondered about this, so one day I sat down and developed the equations that define the semi-trailing arm geometry. The equations for camber and toe on a semi-trailing arm rear suspension are shown below:

$$camber = \sin^{-1}[\sin\theta \sin\alpha]$$

$$toe = -\tan^{-1}\left[\frac{\sin\theta\cos\alpha}{\cos\theta}\right]$$

where

problem. It's mostly a matter of drawing the correct diagram and then applying some geometry and trigonometry.

View the calculations used to develop the camber and toe equations.

The angle theta in the above equations is the trailing arm angle. It is this angle that makes the E30 trailing arms "semi-trailing" as opposed to "pure-trailing". A pure trailing arm would have an angle of theta = 0 deg. The E30 trailing arm angle is 15 deg. Some refer to this as the "sweep" angle.

During the Touring Car era for the E30 M3, BMW Motorsport offered a special Gruppe A subframe and trailing arm combination which employed a 12 deg. trailing arm angle. The exact effect of this change will become apparent on the following pages.

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