

In my first article, I wrote about those wizened beings who occasionally materialise from the ether, intent on stretching the boundaries of plausibility with their over-active imaginations. These people would have us believe that a generous sprinkling of their particular flavour of fairy dust on your hi-fi will transport it to the realms of godliness.

After publication, I was contacted by one of Helius' distributors who suggested he'd been persuaded by one such Svengali and purchased a packet of 'Magic Pebbles' ....guaranteed ( for a remarkably modest price that entered three figures ) to transform your hi-fi into a dynamic, larger-than-life super system that would thrash anything selling for 3 times the price.

All that was required was to place these colourful crystals in strategic locations around your power-amp.

At this juncture, I know what you're thinking – here comes the ridicule...alas not.

Apparently, and much to the consternation of the distributor in question, these Magic Pebbles *did* appear to have some positive effect. ( Don't you just hate it when that happens?)

Curious to ascertain how this might be, he exchanged the colourful crystals for a tin of Heinz baked beans ( at a hundredth of the price ) and repeated the experiment.

Curiously, he experienced much the same improvement.

Not convinced such wizardry could come from the belly of the Dark Side he sought more plausible explanations and, though not as romantic as the metaphysical version, I assured him they existed within the equations of James Clark Maxwell.

Mass-damping, is the most likely culprit/answer. In this instance, my guess was there existed an interplay of electric/magnetic fields with the electro-mechanical parts.

It still amuses me when working on loudspeaker crossovers networks, that a signal of around 50Hz, or lower, fed into two ferrite cored inductors placed back-to-back, with opposing polarity, syncopate quite spectacularly.

As the oscillating electric fields inevitably generate their magnetic component, the resultant physical response is for the inductors to pull-and-push against each other cyclically. I always found Kraftwerk produced the best demonstration of the phenomenon.

My point here is that any interaction between components that create strong electromagnetic fields will result in a physical reaction. As the (electrically neutral) little stones could not possibly have negated the effects of Maxwell's fields, they could only have served to influence/stabilise the mechanics.

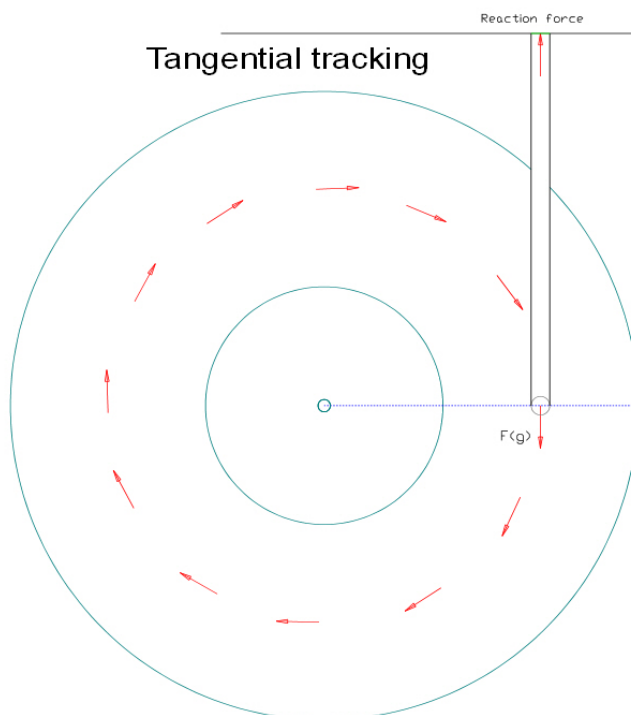
This neatly brings me to as aspect of audio engineering that deserves mentioning. The cost of a product is not always a reflection of the value of the individual components, but rather the embodiment of the experience, knowledge and design philosophy of the engineer behind a given design.

Anyway - I suppose it's time to get to the point of this article (as the original brief was to discuss the nature of bias force in tonearms) and I seem to have drifted.

In explaining how the force arises, I'm going to use several illustrations to describe the nature of bias force, and I'm going to start with a very unrealistic geometric condition.

In terms of the mechanical engineering, however, forces have no comprehension of geometry – they just manifest themselves in two ways – 1) magnitude 2) direction vector.

Consider the following.



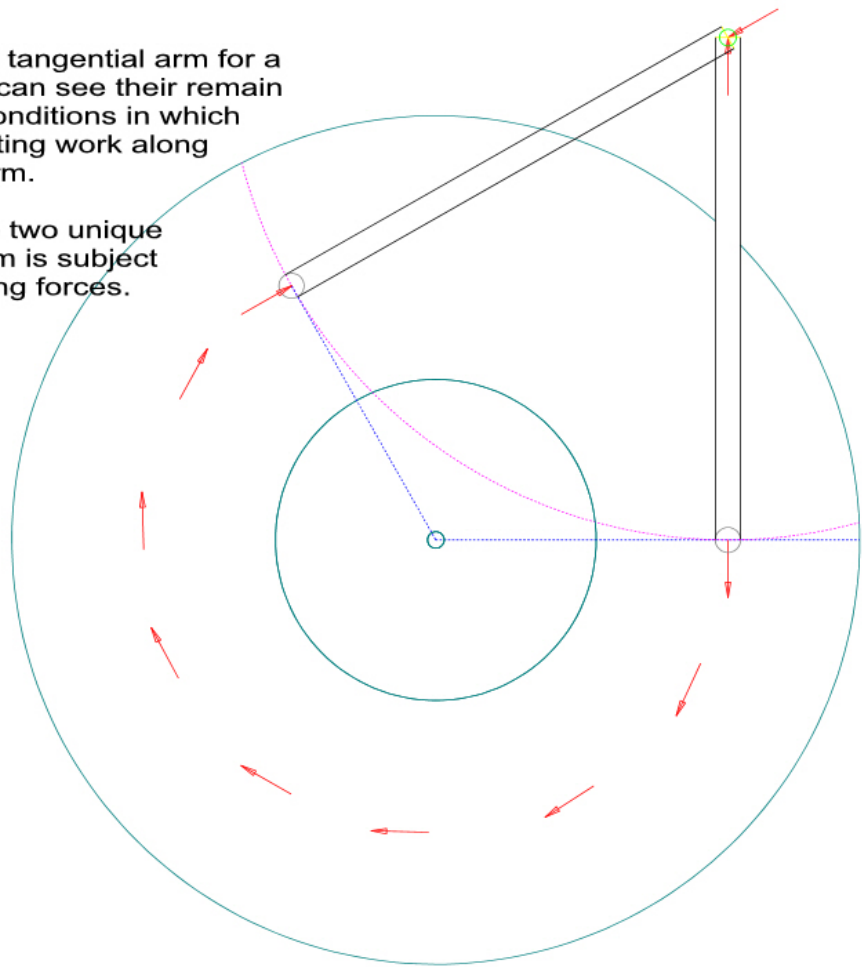
In this scenario, the forces are acting purely along the axis of the arm, therefore there is no skating or bias force.

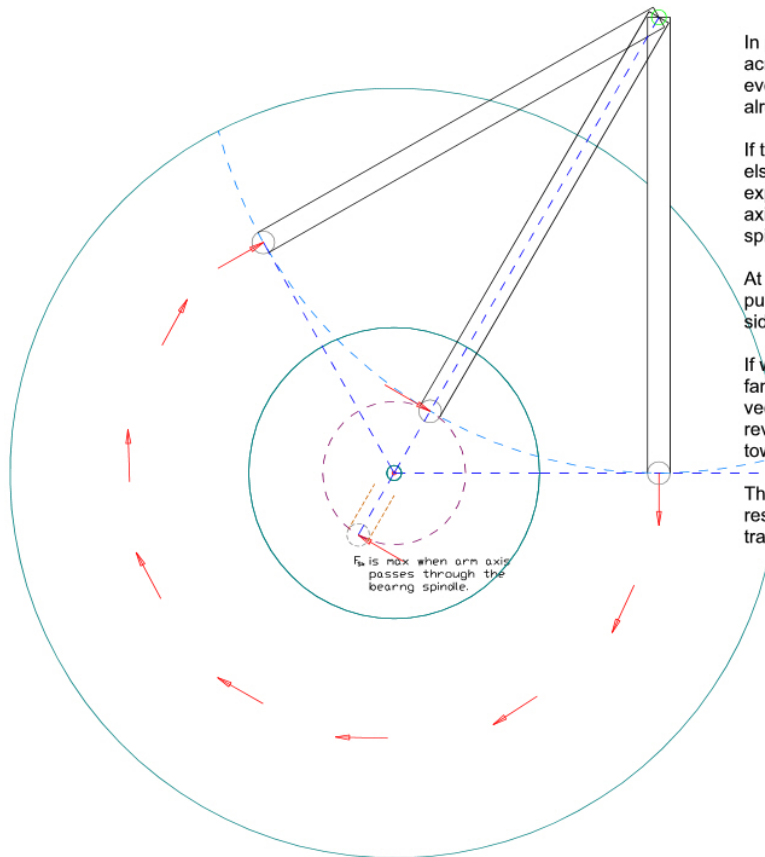
In effect, the stylus is being 'pulled' by the groove.

The complication is that the groove spirals inwards - so the arm needs to be driven electro-mechanically.

If we replace the tangential arm for a pivoted unit, we can see their remain two ( fleeting ) conditions in which the forces operating work along the axis of the arm.

Apart from these two unique positions, the arm is subject substantial skating forces.





In playing a record, a pivoted arm will sweep across the surface, experiencing a side thrust at every point - bar the two momentary exceptions already mentioned.

If the force is zero at one point, but  $>0$  everywhere else, it follows that skating force also has to experience a maximum - and this occurs when the axis of the arm coincides also runs through turntable spindle.

At this point there is no music as the stylus is not pulling through the groove - there is just pure side-thrust.

If we now extend the arm length to something more familiar, you can see how the direction of the skating vector remains the same in magnitude, but has reversed direction - the arm is now pulling inwards towards the centre of the record.

This, of course, means the arm needs to apply a restorative force to negate/neutralise the effect as tracking ability will otherwise be compromised.