

Balancing the swing – The Split voice coil

There's a little girl on a swing. When the swing goes back, dad pushes it forward. When it goes forth, mom pushes it backwards.

If dad and mom push with the same strength, the girl moves equally back and forth, and the centre of the oscillation is in the midpoint. But if dad pushes harder, the little girl (and the swing) spend more time on mom's side, and the average position is pushed forward. The little girl moves away from the stronger force.



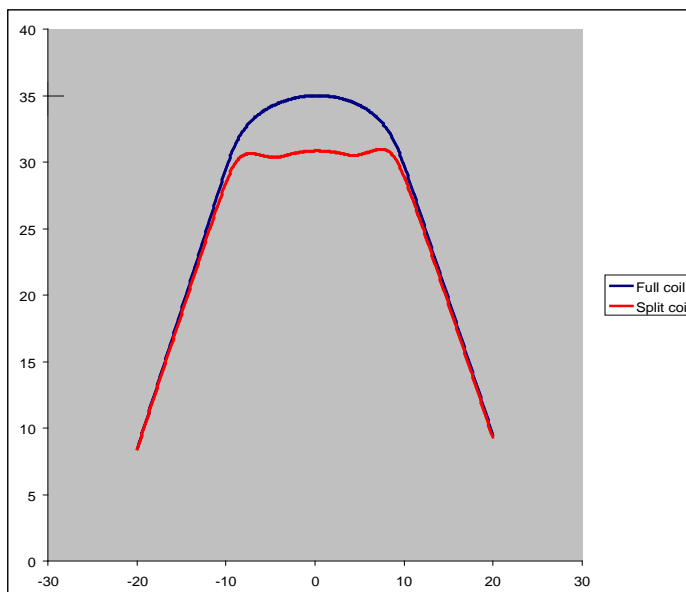
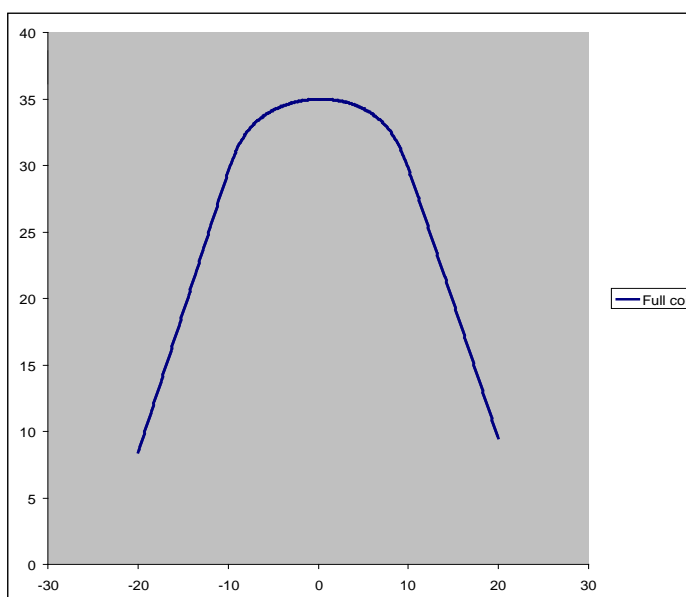
The loudspeaker cone is like the girl on the swing. In an ideal loudspeaker, the strength of the electrodynamic motor is constant everywhere, so dad and mom always push equally. But in a real loudspeaker, the strength varies with position and the cone tends to move away from the zone where the motor is stronger.

If we graph motor strength versus position in a normal loudspeaker, we get the bell-shaped curve in figure. With such a curve, the slightest asymmetry pushes the cone away from the top of the bell and makes it slide on the sides of the curve. This is what causes DC offset.

If we split the coil in the centre of the winding, we chop off the top of the curve and we get a flat zone, where the motor strength is uniform and there are no forces pushing the cone away. This effectively counteracts the DC offset effect.

Because a loudspeaker is designed to work at its best when the coil is centered in the air gap, the bad effects of working most of the time out of the gap include:

- reduced efficiency: it's useless to have a strong BI in the center position, if you're almost never there.
- increased distortion: the more you are away from the gap, the worst the sound becomes. Loss of symmetry, overstretched suspensions and so on.
- mechanical stress: if the suspensions and the cone are always pulled in the same direction, they're much more likely to bend and break.
- possible thermal failure: the main heat sinks for the voice coil are the pole and top plate. The more the coil stays away from them, the more likely it is to burn.



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