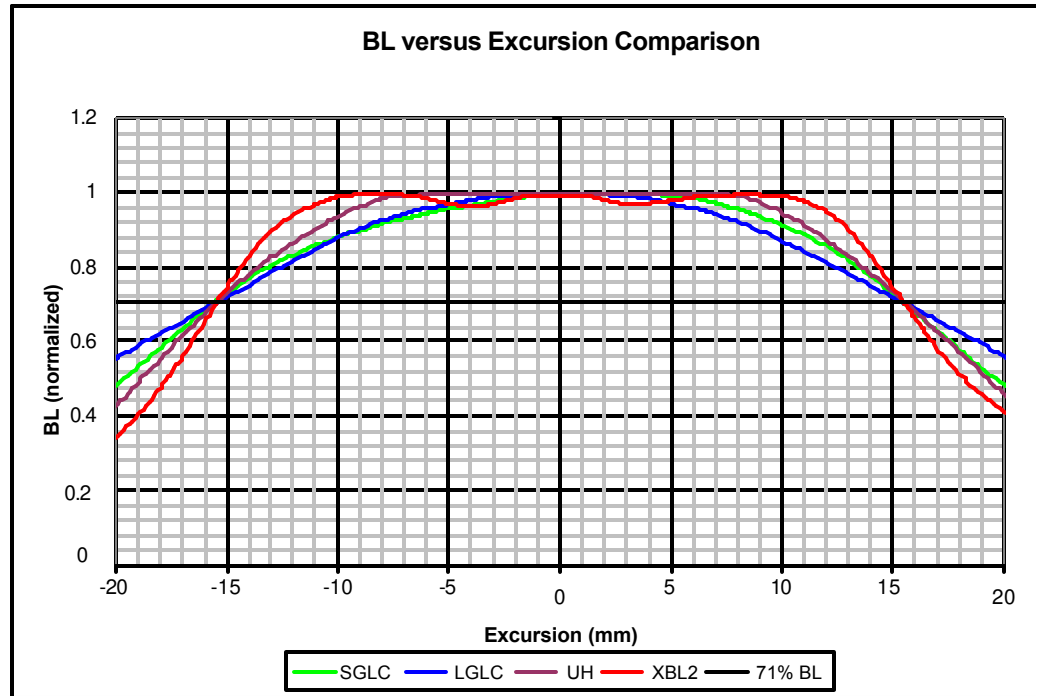




Adire Audio utilizes a patented technology for linearizing loudspeaker drivers: eXtreme BL Linearity, or **XBL²**. This technology greatly flattens the BL curve (motor strength) over the majority of the driver’s usable excursion, with typically no net increase in production cost. The flatter BL curve means lower distortion (see Dr. Wolfgang Klippel, et al).

The graph to the right shows an FEA comparison of the BL-versus-excursion of several driver motor topologies. These are the traditional short-gap/long-coil (**SGLC**), new-style long-gap/ long-coil (**LGLC**), traditional underhung (**UH**), and our new **XBL²** motor topology. Each motor was optimized for a “typical” subwoofer Xmax value of 15.4mm one way, linear. As shown in the graph, the **XBL²** motor offers a much flatter BL. In fact **XBL²** motor has less than 5% BL



decrease over 24mm of total excursion, while the other topologies range from 12 to 18mm for the same percentage of BL decrease. When **XBL²** has dropped 10% of its BL, the other motors have decreased between 18% and 23%. **XBL²** motors offer significant advances in BL linearity, meaning shorter coils and top plates can be used when targeting a specific operating range. Typically an **XBL²** motor uses the shortest voice coil length of any topology for a 10% BL variance.

Motor	Top Plate	Voice coil
SGLC	0.31"	1.43"
LGLC	0.80"	1.53"
UH	1.10"	0.51"
XBL²	0.85"	0.62"

The top plate and coil lengths for these example motors are summarized in the table to the left. The **XBL²** motor uses a voice coil nearly as short as that of the traditional underhung unit, which yields the typical advantages of an underhung design: low moving mass and low inductance. At the same time, the **XBL²** motor is considerably flatter in BL, has equivalent excursion, and uses a much shorter top plate than the underhung unit (which greatly reduces

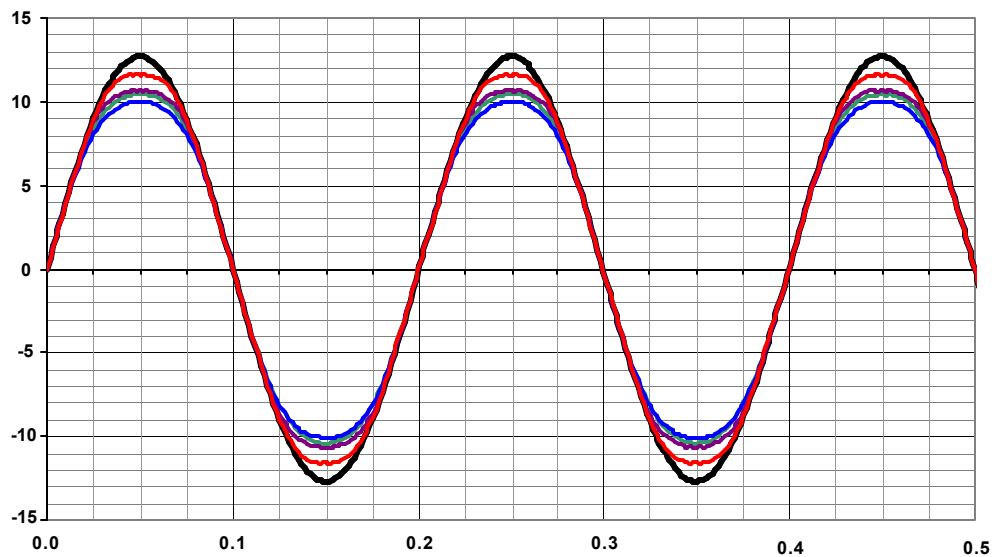
the production cost). Compared to the overhung designs, the shorter coil length means more mechanical clearance in the motor and higher tolerance of rocking, meaning dual spiders are not required for high excursions. Combine this with a flatter BL curve, lower inductance, and lower moving mass and the advantages of XBL2 over overhung topologies - both performance and price - are readily apparent.



XBL² reduces distortion. Keeping the BL flat means more constant motor force at excursion, which means better tracking of large-signal inputs. The graph below shows the output waveform for each of the above motors, when trying to follow an ideal $\pm 12.7\text{mm}$ excursion signal. As shown, **XBL²** best tracks the input signal when the target excursion is still well within the “usable” excursion limits of the driver (rated X_{max} of 15.4mm). As is evident, the **XBL²** motor is much closer to the input signal.

This advantage translates into directly measurable and audible performance improvements in distortion. For the example motors analyzed in this paper, the distortion figures are given for $\pm 10.8\text{mm}$ excursion (70% of X_{max}). The **XBL²** motor has less than 30% of the distortion present in the other motors. **XBL²** motors are useful for all audio transducers. While this example has focused on woofers, the advantages are also applicable for midranges and tweeters.

Waveforms at 12.7mm X_{max}



— Ideal — SGLC — LGLC — UH — XBL²

THD at 10.8mm X_{max}	
SGLC	3.5%
LGLC	4.4%
UH	4.0%
XBL ²	1.0%

In fact, the low inductance and moving mass of this motor are extremely beneficial in wideband transducers. Typically, **XBL²** will halve the inductance of a comparable-excursion overhung motor, which can result in adding a full octave of extension on the high end. Add in the lower moving mass from the short coil, and the driver designer has a greater degree of flexibility in driver creation. **XBL²** represents a major step forward

SUMMARY OF BENEFITS

- **Flatter BL**
- **Lower Distortion**
- **Low Inductance**
- **Low Moving Mass**
- **Reduced Clearance Issues**
- **Applicable to All Drivers**

in loudspeaker design. To show its production viability, Adire Audio has implemented this technology in several loudspeakers, including their Brahma series car audio subwoofers which has a Klippel-verified X_{max} of $\pm 27.3\text{mm}$ with only a 1.1” long voice coil. The **XBL²** technology has also be implemented on the Tumult, Koda, Extremis 6.8 Midrange, and Koda Component drivers.