TECHNICAL PAPER

Transducer electrical equivalent circuit

Traditional model

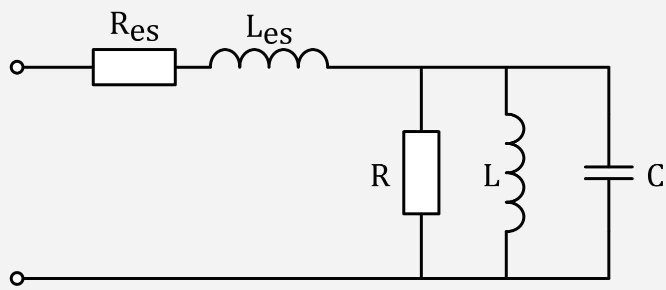

Fig. 1

$L = (Bl)^2 \times C_{ms}$

$C = \frac{M_{ms}}{(Bl)^2}$

$R = \frac{(Bl)^2}{R_{ms}}$

M_{ms}	Driver moving mass incl. air
C_{ms}	Driver suspension compliance
R_{ms}	Driver mechanical loss
Bl	Driver force factor
R_{es}	Voice coil DC resistance
L_{es}	Voice coil inductance

This page shows the differences between the traditional loudspeaker model (fig. 1 above) and the Wright empirical model (fig. 2 below).
The only difference between the two models is that the inductor Les of the traditional model has been replaced by a more complicated component with frequency dependent

$$Z_{em} = K_{rm} \times \omega^{E_{rm}} + j \times K_{xm} \times \omega^{E_{xm}} \qquad \omega = 2\pi f$$

While the traditional model in many cases is very inaccurate at higher frequencies, the Wright model is usually much more accurate. There is not a big difference at low frequencies (bass tuning, for instance) but for crossover designs the traditional model is often not usable.

Wright empirical model

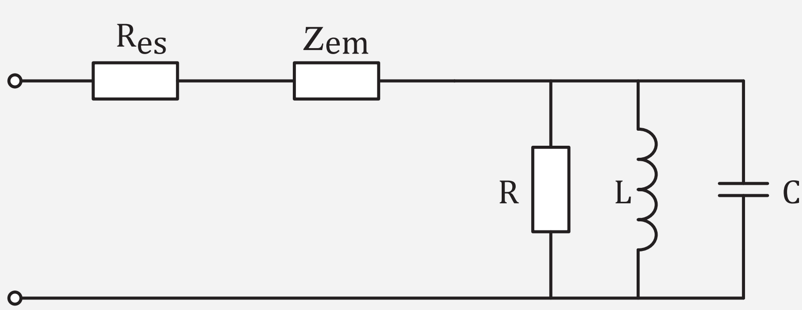

Fig. 2

$L = (Bl)^2 \times C_{ms}$

$C = \frac{M_{ms}}{(Bl)^2}$

$R = \frac{(Bl)^2}{R_{ms}}$

M_{ms}	Driver moving mass incl. air
C_{ms}	Driver suspension compliance
R_{ms}	Driver mechanical loss
Bl	Driver force factor
S_D	Driver effective cone area
R_{es}	Voice coil DC resistance
Z_{em}	Replaces L_{es} from the traditional model

REFERENCES. J. R. Wright, "An empirical model for loudspeaker motor impedance", J. Audio Eng. Soc., Vol. 38, No. 10, 1990.