Driver in a ML TQWT - Acoustic and Electrical Response

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Unit and Constant Definition

$cycle := 2 \cdot \pi \cdot rad$

$Hz := cycle \cdot sec^{-1}$

Air Density : $\rho := 1.21 \cdot kg \cdot m^{-3}$

Speed of Sound : $c := 342 \cdot m \cdot sec^{-1}$

Part 1 : Thiele-Small Consistent Calculation

Abbreviated User Input (Edit This Section and Input the Parameters for the System to be Analyzed)

Series Resistance

$R_{add} := 0.0 \cdot \Omega$

Driver Thiele / Small Parameters : ~~Fostex FE-164 Average Driver Properties~~

Parameters for JX125 OEM

$f_d := 48 \cdot Hz$

$R_e := 6.6 \cdot \Omega$

$L_{vc} := .465 \cdot mH$

$Bl := 6.386 \cdot \frac{newton}{amp}$

$S_d := 132 \cdot cm^2$

$V_{ad} := 15.85 \cdot liter$

$Q_{ed} := .824$

$Q_{md} := 3.5$

$Q_{td} := \left(\frac{1}{Q_{ed}} + \frac{1}{Q_{md}} \right)^{-1}$

$Q_{td} = 0.667$

Adjustments

$R_e := R_e + R_{add}$

$Q_{ed} := Q_{ed} \cdot R_e \cdot \left(R_e - R_{add} \right)^{-1}$

Enclosure Geometry Definition : Model of Internal Air Volume

Typical Existing Box

$L := 47.5 \cdot in$ (Internal Height)

$z_{driver} := 15.5 \cdot in$ (Driver Internal Distance From Top < Height)

$z_{port} := 45 \cdot in$ (Port Internal Distance From Top < Height)

$S_0 := 30.0 \cdot in \cdot 10 \cdot in$ (Internal Area of the Top End, z = 0)

$S_L := 30.0 \cdot in \cdot 10 \cdot in$ (Internal Area of the Bottom End, z = L)

$Density := 0.25 \cdot lb \cdot ft^{-3}$ (Stuffing density : 0 lb/ft^3 < D < 1 lb/ft^3)

New Port Dimensions!

$r_{port} := 1.5 \cdot in$ (Inside Radius of the Port)

$L_{port} := 1.75 \cdot in$ (Length of the Port)

$Power := 1 \cdot watt$ (Input Power) Applied Voltage Reference ---> $R_{ref} := 8 \cdot \Omega$

End of Abbreviated User Input

Pre Formated Geometry and Stuffing Location Input (Only Edit Details Below to Change Defaults)

Ported Box Definition (0 lb/ft^3 < D < 1 lb/ft^3)

n_top := 4 (n_top > 1) $x_{top} := z_{driver}$

n_open := 4 (n_open > 1) $x_{open} := z_{port} - z_{driver}$

n_bottom := 4 (n_bottom > 1) $x_{bottom} := L - z_{port}$

n_port := 4 (n_port > 1) $x_{port} := L_{port} + 0.6 \cdot r_{port}$

Geometry Definition

$TR := (S_L - S_0) \cdot L^{-1}$ $TR = 0\,m$

$S_D := S_0 + TR \cdot z_{driver}$ $S_D = 0.194\,m^2$

$S_P := S_0 + TR \cdot z_{port}$ $S_P = 0.194\,m^2$

Top Section of Enclosure (Driver ---> Top of Enclosure)

Section Length	Initial Area	Final Area	Stuffing Density
$L_{c_0} := x_{top} \cdot (n\_top + 1)^{-1}$	$S_{c_{0,0}} := S_D$	$S_{c_{0,1}} := S_{c_{0,0}} - TR \cdot L_{c_0}$	$D_{c_0} :=$ Density
$L_{c_1} := x_{top} \cdot (n\_top + 1)^{-1}$	$S_{c_{1,0}} := S_{c_{0,1}}$	$S_{c_{1,1}} := S_{c_{1,0}} - TR \cdot L_{c_1}$	$D_{c_1} :=$ Density
$L_{c_2} := x_{top} \cdot (n\_top + 1)^{-1}$	$S_{c_{2,0}} := S_{c_{1,1}}$	$S_{c_{2,1}} := S_{c_{2,0}} - TR \cdot L_{c_2}$	$D_{c_2} :=$ Density
$L_{c_3} := x_{top} \cdot (n\_top + 1)^{-1}$	$S_{c_{3,0}} := S_{c_{2,1}}$	$S_{c_{3,1}} := S_{c_{3,0}} - TR \cdot L_{c_3}$	$D_{c_3} :=$ Density
$L_{c_4} := x_{top} \cdot (n\_top + 1)^{-1}$	$S_{c_{4,0}} := S_{c_{3,1}}$	$S_{c_{4,1}} := S_0$	$D_{c_4} :=$ Density

Open Section of Enclosure (Driver ---> Port Position)

Section Length	Initial Area	Final Area	Stuffing Density
$L_{o_0} := x_{open} \cdot (n\_open + 1)^{-1}$	$S_{o_{0,0}} := S_D$	$S_{o_{0,1}} := S_{o_{0,0}} + TR \cdot L_{o_0}$	$D_{o_0} :=$ Density
$L_{o_1} := x_{open} \cdot (n\_open + 1)^{-1}$	$S_{o_{1,0}} := S_{o_{0,1}}$	$S_{o_{1,1}} := S_{o_{1,0}} + TR \cdot L_{o_1}$	$D_{o_1} :=$ Density
$L_{o_2} := x_{open} \cdot (n\_open + 1)^{-1}$	$S_{o_{2,0}} := S_{o_{1,1}}$	$S_{o_{2,1}} := S_{o_{2,0}} + TR \cdot L_{o_2}$	$D_{o_2} :=$ Density
$L_{o_3} := x_{open} \cdot (n\_open + 1)^{-1}$	$S_{o_{3,0}} := S_{o_{2,1}}$	$S_{o_{3,1}} := S_{o_{3,0}} + TR \cdot L_{o_3}$	$D_{o_3} :=$ Density
$L_{o_4} := x_{open} \cdot (n\_open + 1)^{-1}$	$S_{o_{4,0}} := S_{o_{3,1}}$	$S_{o_{4,1}} := S_P$	$D_{o_4} :=$ Density

Bottom Section of Enclosure (Port Position ---> Bottom of Enclosure)

Section Length	Initial Area	Final Area	Stuffing Density
$L_{b_0} := x_{bottom} \cdot (n\_bottom + 1)^{-1}$	$S_{b_{0,0}} := S_P$	$S_{b_{0,1}} := S_{b_{0,0}} + TR \cdot L_{b_0}$	$D_{b_0} := 0.0 \cdot lb \cdot ft^{-3}$
$L_{b_1} := x_{bottom} \cdot (n\_bottom + 1)^{-1}$	$S_{b_{1,0}} := S_{b_{0,1}}$	$S_{b_{1,1}} := S_{b_{1,0}} + TR \cdot L_{b_1}$	$D_{b_1} := 0.0 \cdot lb \cdot ft^{-3}$
$L_{b_2} := x_{bottom} \cdot (n\_bottom + 1)^{-1}$	$S_{b_{2,0}} := S_{b_{1,1}}$	$S_{b_{2,1}} := S_{b_{2,0}} + TR \cdot L_{b_2}$	$D_{b_2} := 0.0 \cdot lb \cdot ft^{-3}$
$L_{b_3} := x_{bottom} \cdot (n\_bottom + 1)^{-1}$	$S_{b_{3,0}} := S_{b_{2,1}}$	$S_{b_{3,1}} := S_{b_{3,0}} + TR \cdot L_{b_3}$	$D_{b_3} := 0.0 \cdot lb \cdot ft^{-3}$
$L_{b_4} := x_{bottom} \cdot (n\_bottom + 1)^{-1}$	$S_{b_{4,0}} := S_{b_{3,1}}$	$S_{b_{4,1}} := S_L$	$D_{b_4} := 0.0 \cdot lb \cdot ft^{-3}$

Port Section of Enclosure (Port Inside ---> Port Outside)

Section Length	Initial Area	Final Area	Stuffing Density
$L_{p_0} := x_{port} \cdot (n\_port + 1)^{-1}$	$S_{p_{0,0}} := \pi \cdot r_{port}^2$	$S_{p_{0,1}} := \pi \cdot r_{port}^2$	$D_{p_0} := 0.0 \cdot lb \cdot ft^{-3}$
$L_{p_1} := x_{port} \cdot (n\_port + 1)^{-1}$	$S_{p_{1,0}} := S_{p_{0,1}}$	$S_{p_{1,1}} := \pi \cdot r_{port}^2$	$D_{p_1} := 0.0 \cdot lb \cdot ft^{-3}$
$L_{p_2} := x_{port} \cdot (n\_port + 1)^{-1}$	$S_{p_{2,0}} := S_{p_{1,1}}$	$S_{p_{2,1}} := \pi \cdot r_{port}^2$	$D_{p_2} := 0.0 \cdot lb \cdot ft^{-3}$
$L_{p_3} := x_{port} \cdot (n\_port + 1)^{-1}$	$S_{p_{3,0}} := S_{p_{2,1}}$	$S_{p_{3,1}} := \pi \cdot r_{port}^2$	$D_{p_3} :=$ Density
$L_{p_4} := x_{port} \cdot (n\_port + 1)^{-1}$	$S_{p_{4,0}} := S_{p_{3,1}}$	$S_{p_{4,1}} := \pi \cdot r_{port}^2$	$D_{p_4} :=$ Density

New Stuffing Added at port!

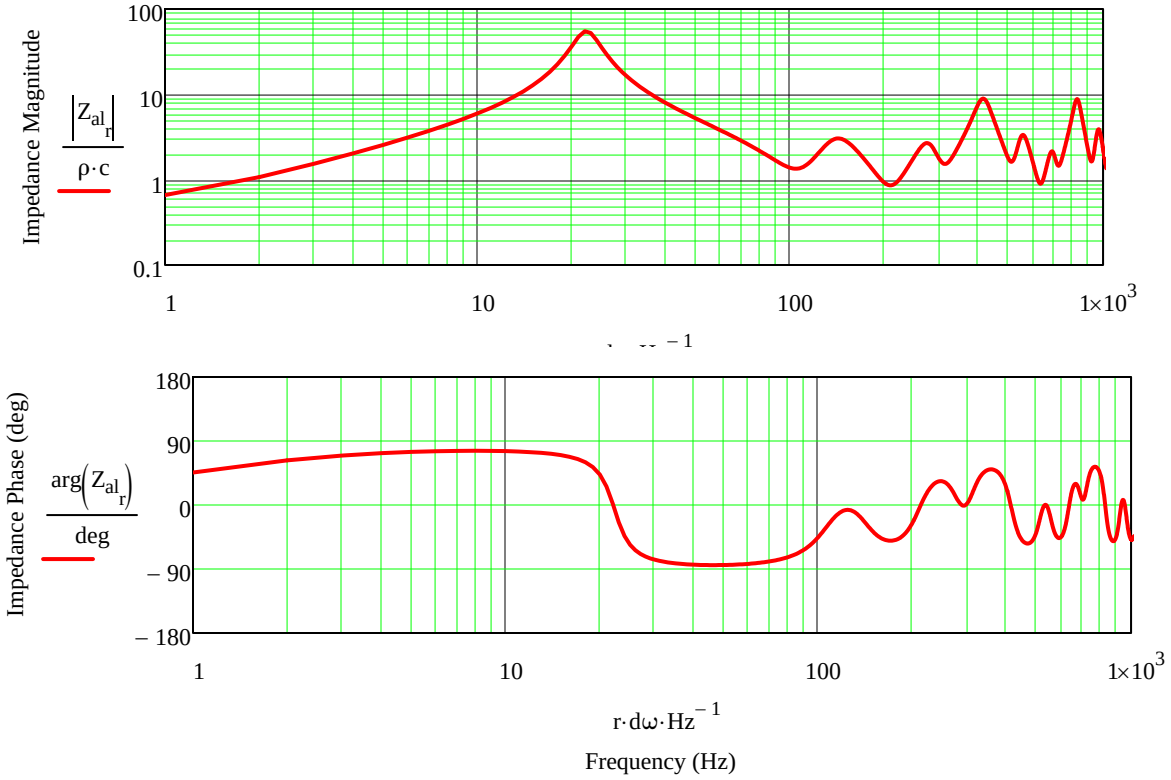
Total Amount of Stuffing

$$\sum_{r=0}^{n\_top}\left[\frac{\left(S_{c_{r,0}} + S_{c_{r,1}}\right)}{2}\cdot L_{c_r}\cdot D_{c_r}\right] + \sum_{r=0}^{n\_open}\left[\frac{\left(S_{o_{r,0}} + S_{o_{r,1}}\right)}{2}\cdot L_{o_r}\cdot D_{o_r}\right] \ldots = 1.954\cdot lb$$
$$+ \sum_{r=0}^{n\_bottom}\left[\frac{\left(S_{b_{r,0}} + S_{b_{r,1}}\right)}{2}\cdot L_{b_r}\cdot D_{b_r}\right] + \sum_{r=0}^{n\_port}\left[\frac{\left(S_{p_{r,0}} + S_{p_{r,1}}\right)}{2}\cdot L_{p_r}\cdot D_{p_r}\right]$$

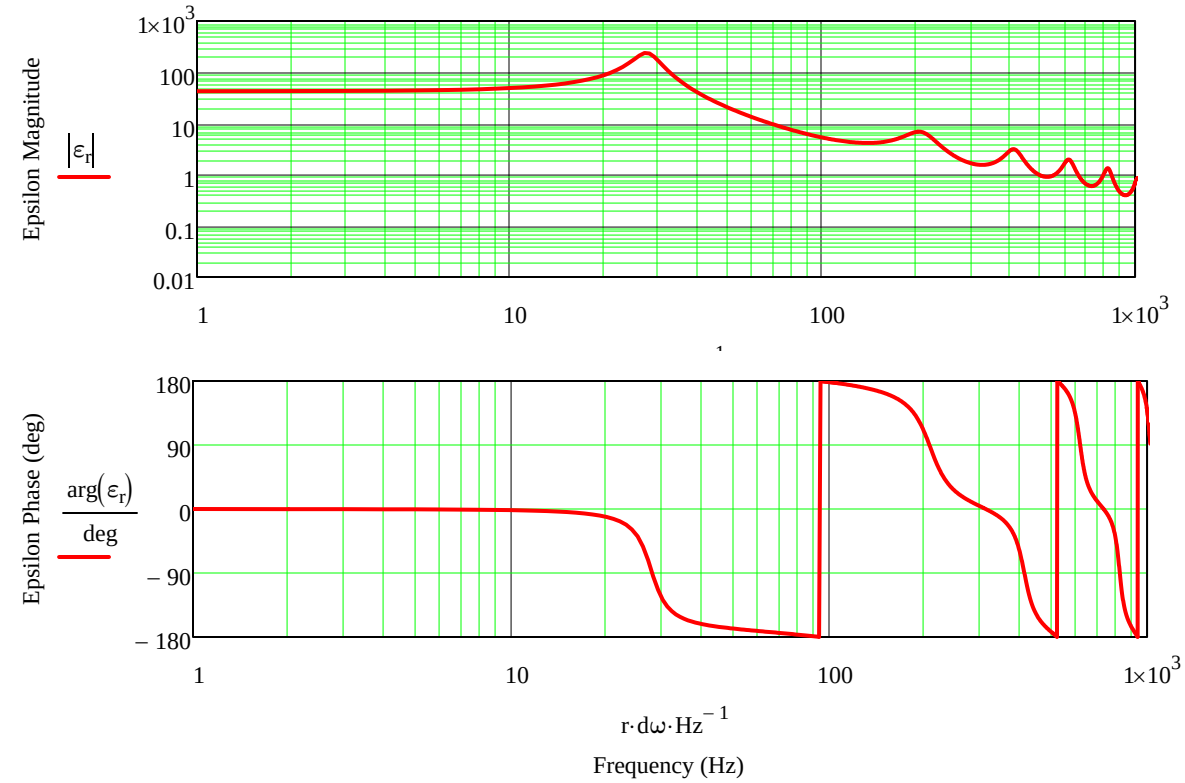
End of Pre Formatted Default Input

End of Part 1 Input

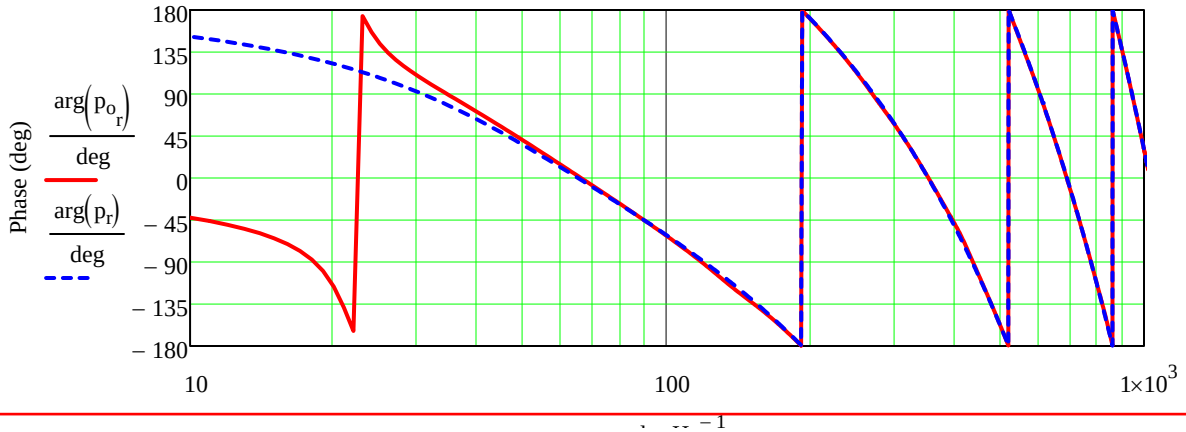
Resulting Acoustic Impedance for the Enclosure

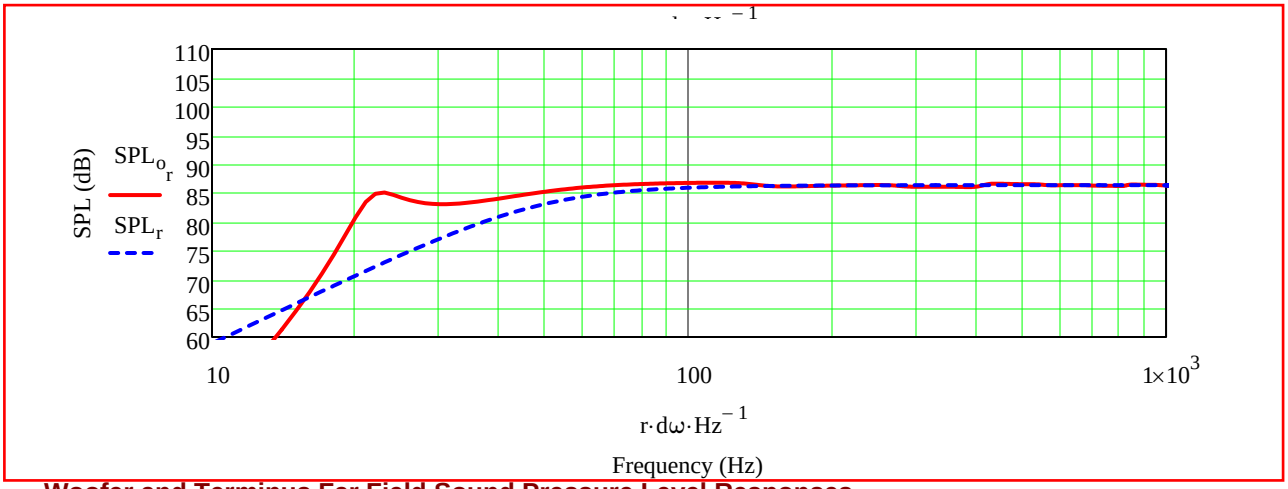


Velocity at the Terminus of the Ported Box for a 1 m/sec Excitation at the Driver Position

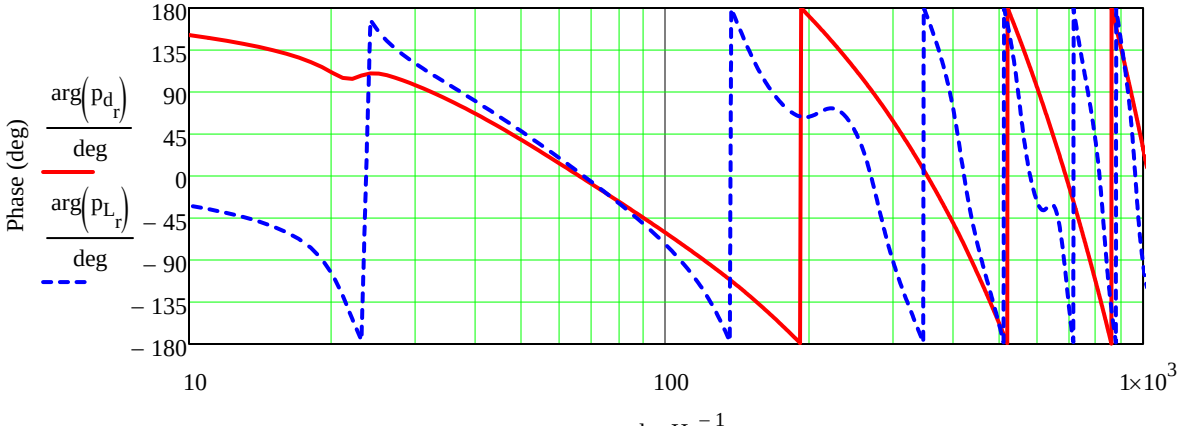


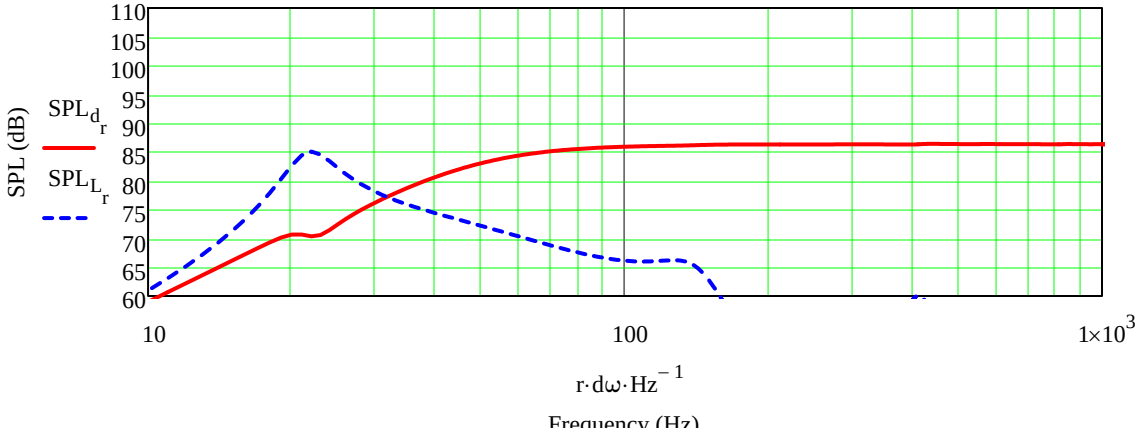
Far Field Ported Box System and Infinite Baffle Sound Pressure Level Responses



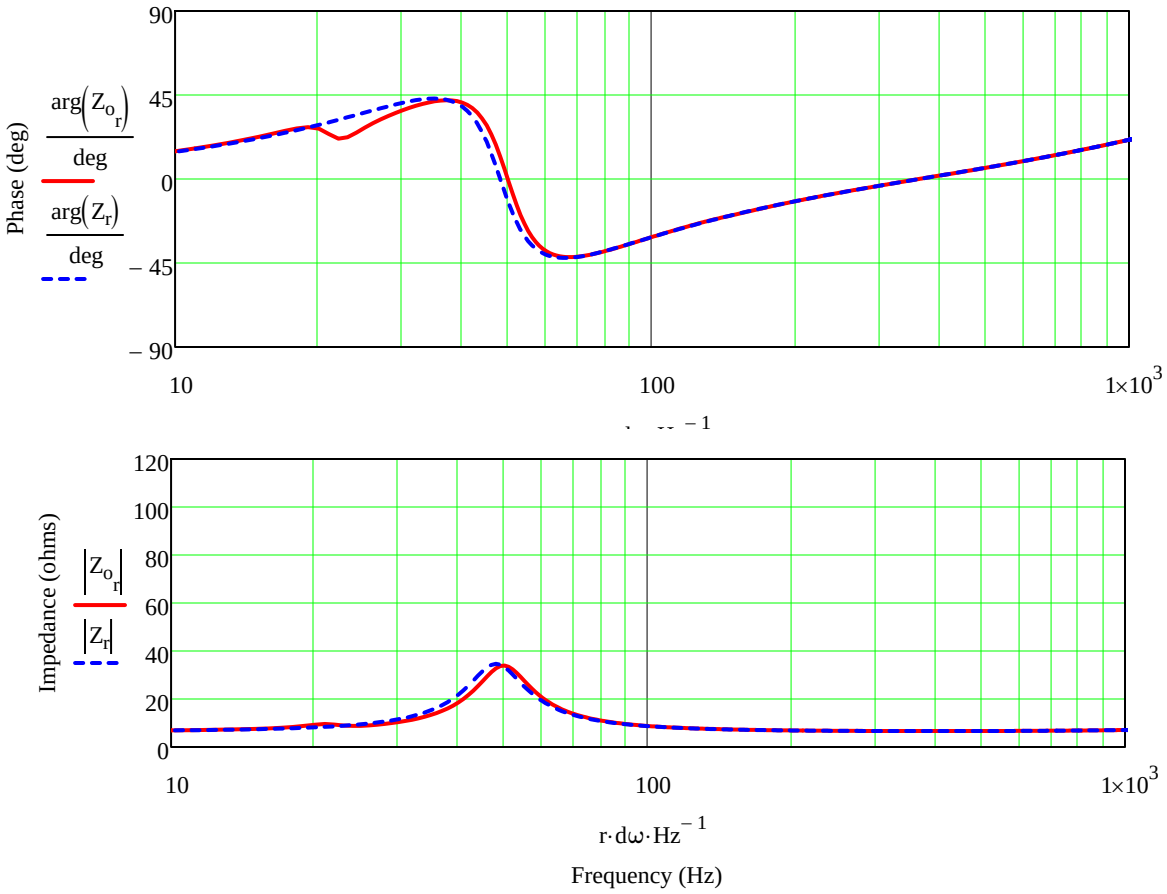


Woofer and Terminus Far Field Sound Pressure Level Responses

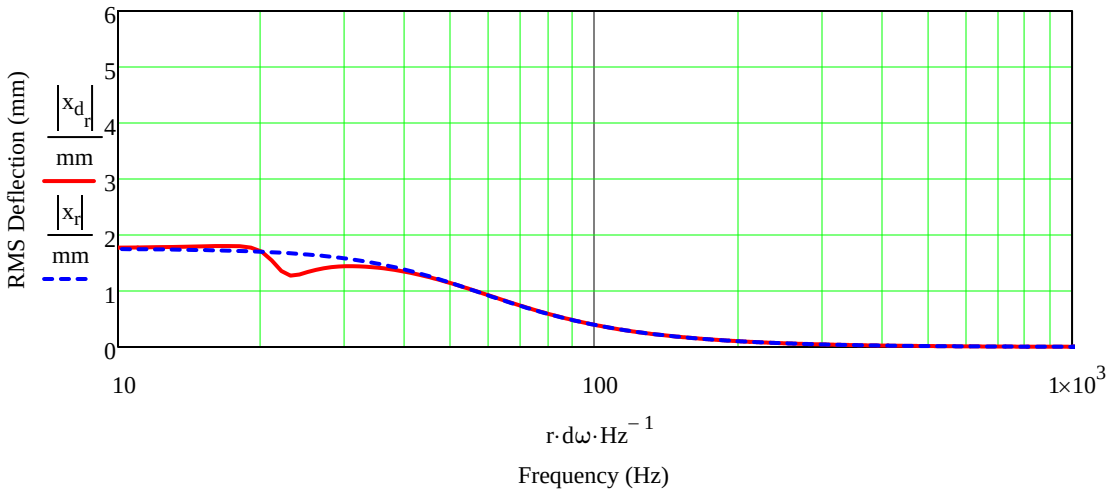




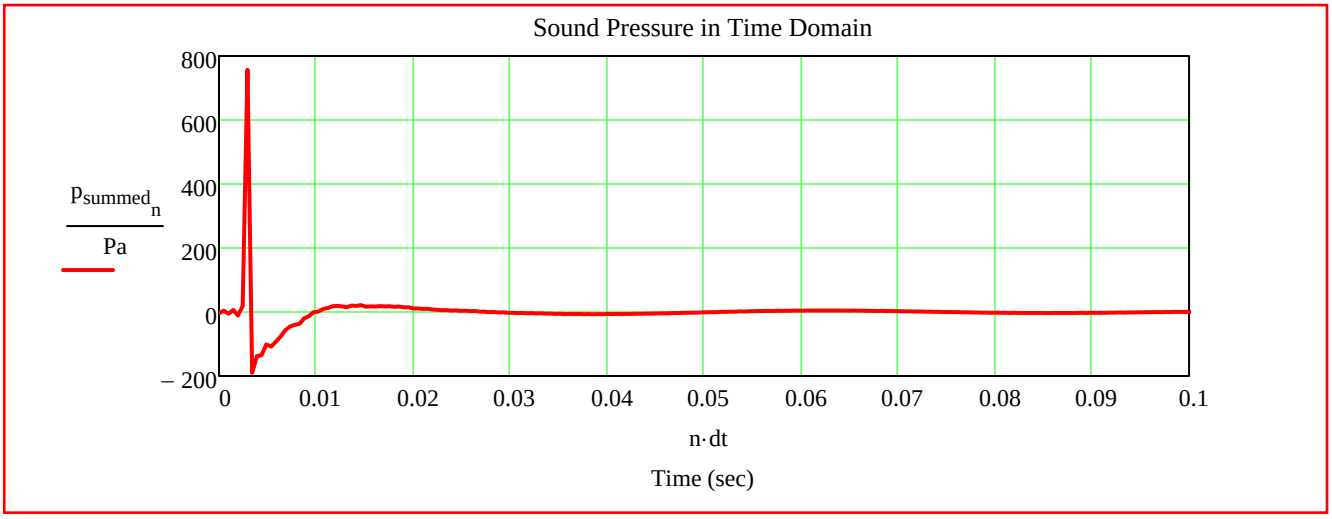
Ported Box System and Infinite Baffle Impedance



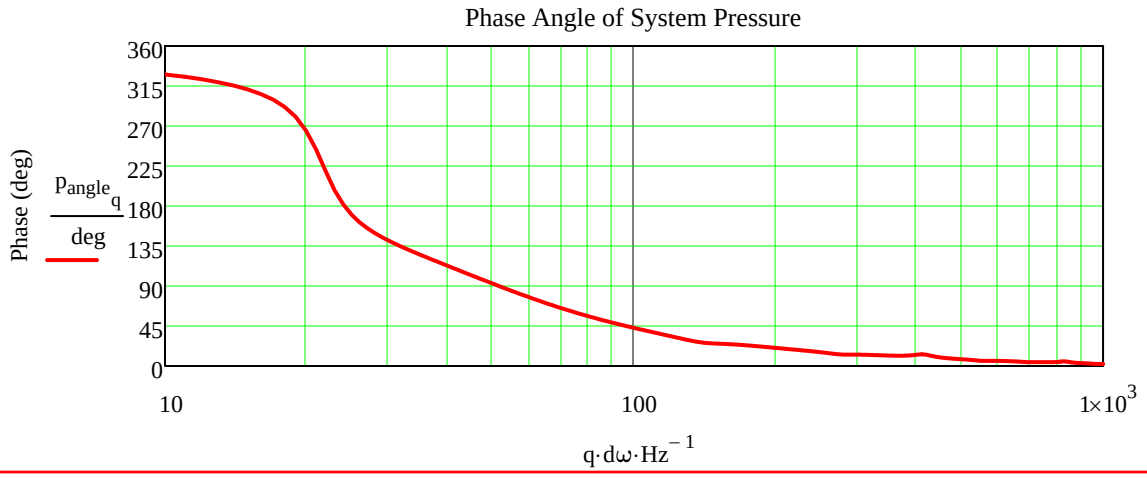
Woofer RMS Displacement

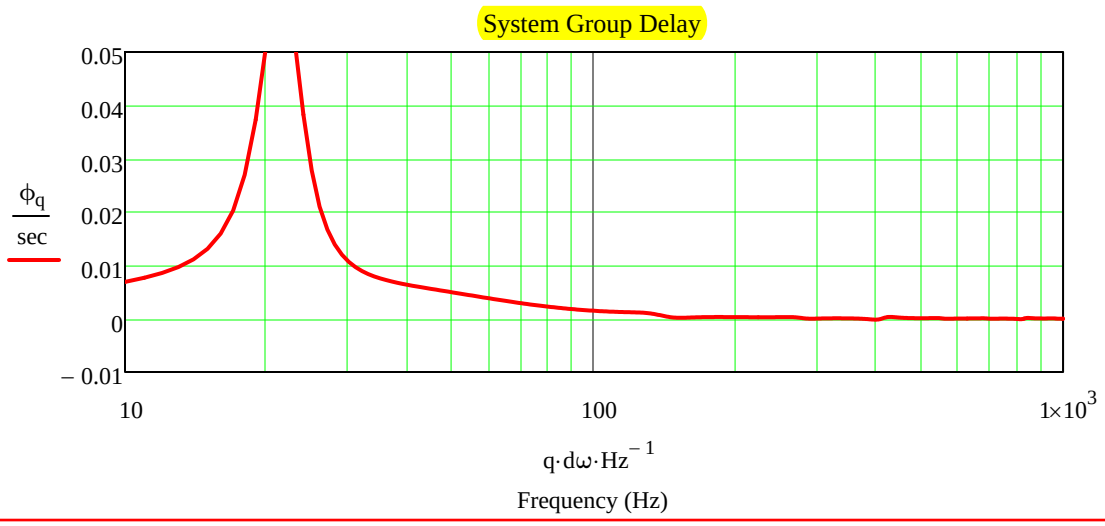


System Time Response for an Impulse Input



System Group Delay





Port Air Velocity (should be < 10 m/sec / 342 m/sec = 0.03)