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### Unit and Constant Definition

$$\text{cycle} := 2 \cdot \pi \cdot \text{rad}$$

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

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

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



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**User Input** (Edit This Section and Input all of the Parameters for the System to be Analyzed)

Driver Thiele / Small Parameters :

$$f_d := 40 \cdot \text{Hz}$$

$$V_d := 30 \cdot \text{liter}$$

$$R_e := 5.9 \cdot \Omega$$

$$Q_{ed} := 0.58$$

$$L_{vc} := 0.7 \cdot \text{mH}$$

$$Q_{md} := 1.94$$

$$Bl := 5.6 \cdot \frac{\text{newton}}{\text{amp}}$$

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

$$S_d := 130 \cdot \text{cm}^2$$

$$Q_{td} = 0.447$$

### Enclosure Geometry Definition

$$L := 42 \cdot \text{in}$$

(Height)

$$z_{\text{driver}} := 7 \cdot \text{in}$$

(Driver Distance From Top < Height)

$$z_{\text{port}} := 40 \cdot \text{in}$$

(Port Distance From Top < Height)

$$S_0 := 60.8 \cdot \text{in}^2$$

(Area of the Top End)

$$S_L := 60.8 \cdot \text{in}^2$$

(Area of the Bottom End)

$$\text{Density} := 0.001 \cdot \text{lb} \cdot \text{ft}^{-3}$$

(Stuffing density :  $0 \text{ lb/ft}^3 < D < 1 \text{ lb/ft}^3$ )

$$r_{\text{port}} := 1.5 \cdot \text{in}$$

(Radius of the port)

$$L_{\text{port}} := 4.25 \cdot \text{in}$$

(Length of the port)

### Ported Box Definition

$$(0 \text{ lb/ft}^3 < D < 1 \text{ lb/ft}^3)$$

$$n_{\text{top}} := 4$$

$$(n_{\text{top}} > 1)$$

$$x_{\text{top}} := z_{\text{driver}}$$

$$n_{\text{open}} := 4$$

$$(n_{\text{open}} > 1)$$

$$x_{\text{open}} := z_{\text{port}} - z_{\text{driver}}$$

$$n_{\text{bottom}} := 4$$

$$(n_{\text{bottom}} > 1)$$

$$x_{\text{bottom}} := L - z_{\text{port}}$$

$$n_{\text{port}} := 4$$

$$(n_{\text{port}} > 1)$$

$$x_{\text{port}} := L_{\text{port}} + 0.6 \cdot r_{\text{port}}$$

### Geometry Definition

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

$$TR = 0 \text{ m}$$

$$S_D := S_0 + TR \cdot z_{\text{driver}}$$

$$S_D = 0.039 \text{ m}^2$$

$$S_P := S_0 + TR \cdot z_{\text{port}}$$

$$S_P = 0.039 \text{ m}^2$$

### Top Section of Enclosure

(Driver ----> Top of Enclosure)

#### Section Length

#### Initial Area

#### Final Area

#### Stuffing Density

$$L_{c_0} := x_{\text{top}} \cdot (n_{\text{top}} + 1)^{-1}$$

$$S_{c_{0,0}} := S_D$$

$$S_{c_{0,1}} := S_{c_{0,0}} - TR \cdot L_{c_0}$$

$$D_{c_0} := \text{Density}$$

$$L_{c_1} := x_{\text{top}} \cdot (n_{\text{top}} + 1)^{-1}$$

$$S_{c_{1,0}} := S_{c_{0,1}}$$

$$S_{c_{1,1}} := S_{c_{1,0}} - TR \cdot L_{c_1}$$

$$D_{c_1} := \text{Density}$$

$$L_{c_2} := x_{\text{top}} \cdot (n_{\text{top}} + 1)^{-1}$$

$$S_{c_{2,0}} := S_{c_{1,1}}$$

$$S_{c_{2,1}} := S_{c_{2,0}} - TR \cdot L_{c_2}$$

$$D_{c_2} := \text{Density}$$

$$L_{c_3} := x_{\text{top}} \cdot (n_{\text{top}} + 1)^{-1}$$

$$S_{c_{3,0}} := S_{c_{2,1}}$$

$$S_{c_{3,1}} := S_{c_{3,0}} - TR \cdot L_{c_3}$$

$$D_{c_3} := \text{Density}$$

$$L_{c_4} := x_{\text{top}} \cdot (n_{\text{top}} + 1)^{-1}$$

$$S_{c_{4,0}} := S_{c_{3,1}}$$

$$S_{c_{4,1}} := S_0$$

$$D_{c_4} := \text{Density}$$

### Open Section of Enclosure

(Driver ----> Port Position)

#### Section Length

#### Initial Area

#### Final Area

#### Stuffing Density

$$L_{o_0} := x_{\text{open}} \cdot (n_{\text{open}} + 1)^{-1}$$

$$S_{o_{0,0}} := S_D$$

$$S_{o_{0,1}} := S_{o_{0,0}} + TR \cdot L_{o_0}$$

$$D_{o_0} := \text{Density}$$

$$L_{o_1} := x_{\text{open}} \cdot (n_{\text{open}} + 1)^{-1}$$

$$S_{o_{1,0}} := S_{o_{0,1}}$$

$$S_{o_{1,1}} := S_{o_{1,0}} + TR \cdot L_{o_1}$$

$$D_{o_1} := \text{Density}$$

$$L_{o_2} := x_{\text{open}} \cdot (n_{\text{open}} + 1)^{-1}$$

$$S_{o_{2,0}} := S_{o_{1,1}}$$

$$S_{o_{2,1}} := S_{o_{2,0}} + TR \cdot L_{o_2}$$

$$D_{o_2} := \text{Density}$$

$$L_{o_3} := x_{\text{open}} \cdot (n_{\text{open}} + 1)^{-1}$$

$$S_{o_{3,0}} := S_{o_{2,1}}$$

$$S_{o_{3,1}} := S_{o_{3,0}} + TR \cdot L_{o_3}$$

$$D_{o_3} := \text{Density}$$

$$L_{o_4} := x_{\text{open}} \cdot (n_{\text{open}} + 1)^{-1}$$

$$S_{o_{4,0}} := S_{o_{3,1}}$$

$$S_{o_{4,1}} := S_P$$

$$D_{o_4} := \text{Density}$$

## Bottom Section of Enclosure

(Port Position ---> Bottom of Enclosure)

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

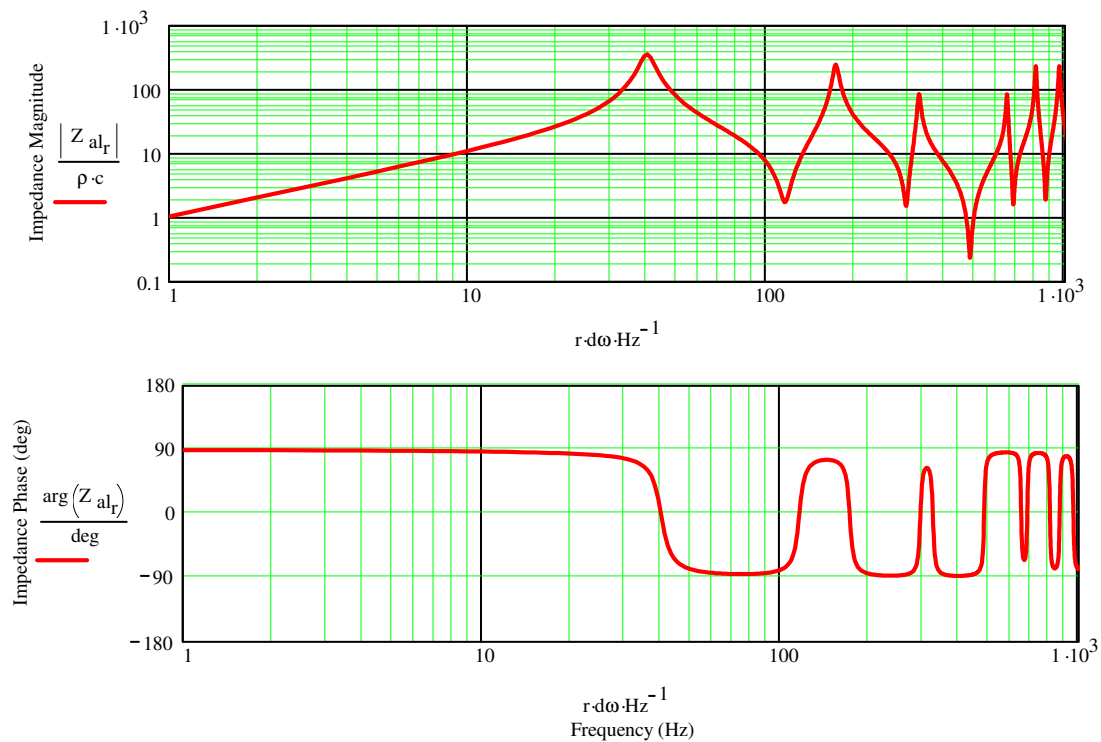
## Port Section of Enclosure

(Port Inside ---> Port Outside)

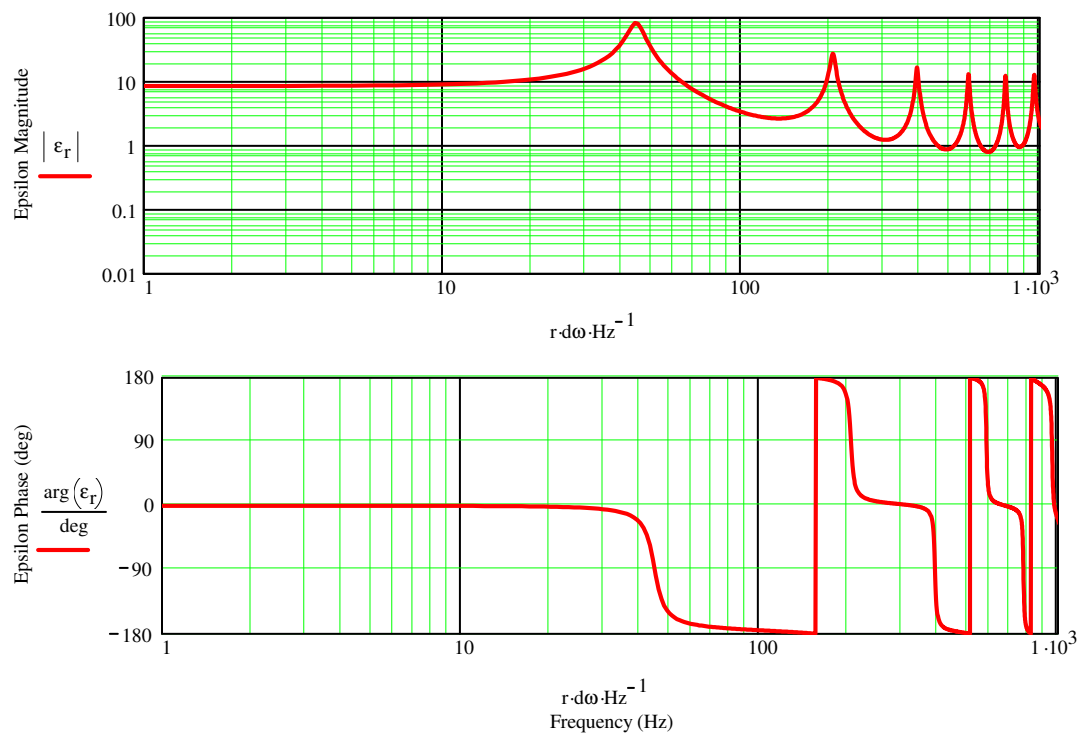
Section Length	Initial Area	Final Area	Stuffing Density
$L_{p_0} := x_{\text{port}} \cdot (n_{\text{port}} + 1)^{-1}$	$S_{p_{0,0}} := \pi \cdot r_{\text{port}}^2$	$S_{p_{0,1}} := \pi \cdot r_{\text{port}}^2$	$D_{p_0} := 0.2 \cdot \text{lb} \cdot \text{ft}^{-3}$
$L_{p_1} := x_{\text{port}} \cdot (n_{\text{port}} + 1)^{-1}$	$S_{p_{1,0}} := S_{p_{0,1}}$	$S_{p_{1,1}} := \pi \cdot r_{\text{port}}^2$	$D_{p_1} := 0 \cdot \text{lb} \cdot \text{ft}^{-3}$
$L_{p_2} := x_{\text{port}} \cdot (n_{\text{port}} + 1)^{-1}$	$S_{p_{2,0}} := S_{p_{1,1}}$	$S_{p_{2,1}} := \pi \cdot r_{\text{port}}^2$	$D_{p_2} := 0 \cdot \text{lb} \cdot \text{ft}^{-3}$
$L_{p_3} := x_{\text{port}} \cdot (n_{\text{port}} + 1)^{-1}$	$S_{p_{3,0}} := S_{p_{2,1}}$	$S_{p_{3,1}} := \pi \cdot r_{\text{port}}^2$	$D_{p_3} := 0 \cdot \text{lb} \cdot \text{ft}^{-3}$
$L_{p_4} := x_{\text{port}} \cdot (n_{\text{port}} + 1)^{-1}$	$S_{p_{4,0}} := S_{p_{3,1}}$	$S_{p_{4,1}} := \pi \cdot r_{\text{port}}^2$	$D_{p_4} := 0 \cdot \text{lb} \cdot \text{ft}^{-3}$



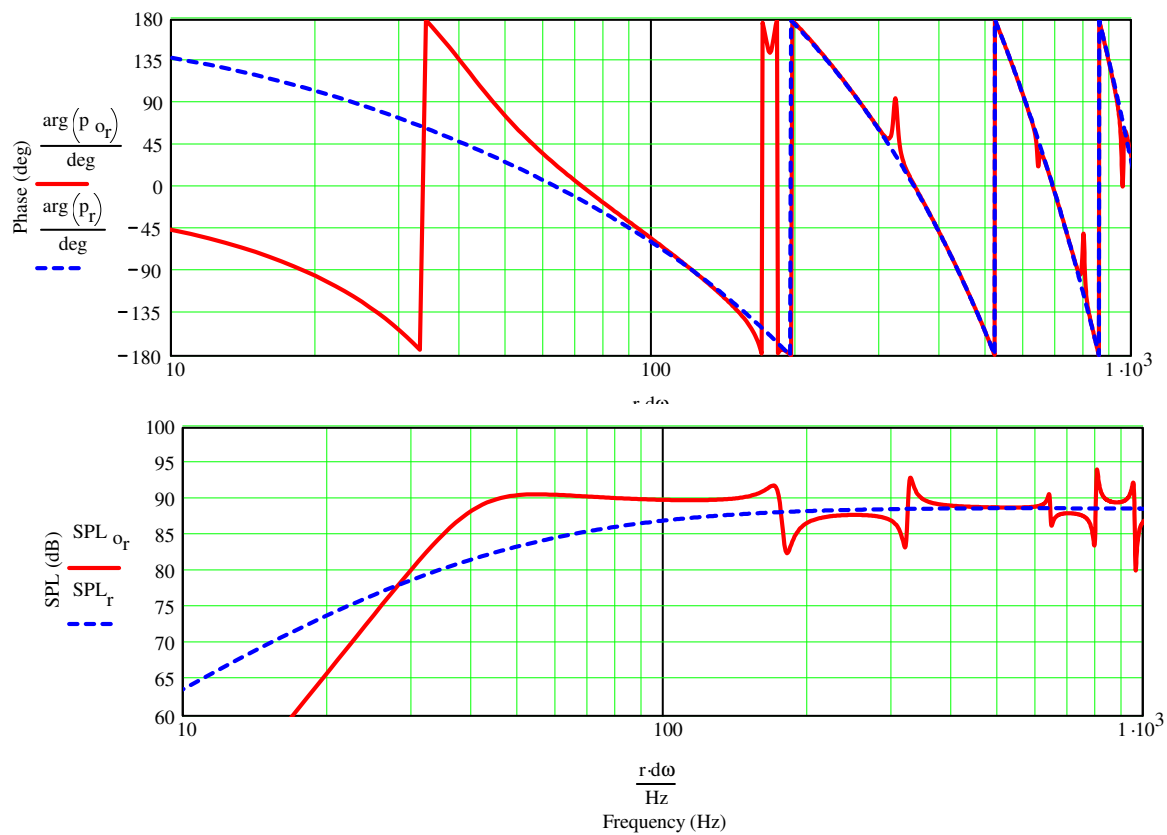
## Resulting Acoustic Impedance for the Enclosure



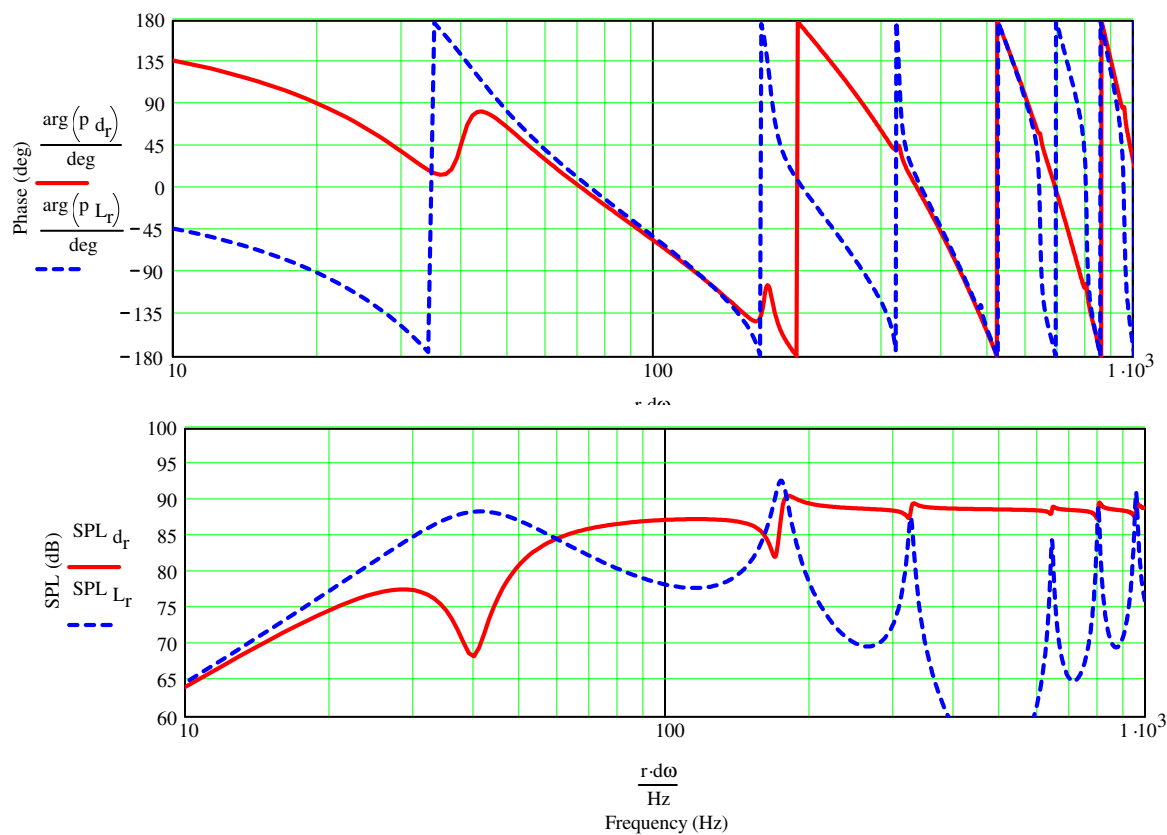
## Velocity at the Terminus of the Ported Box for a 1 m/sec Driver Excitation



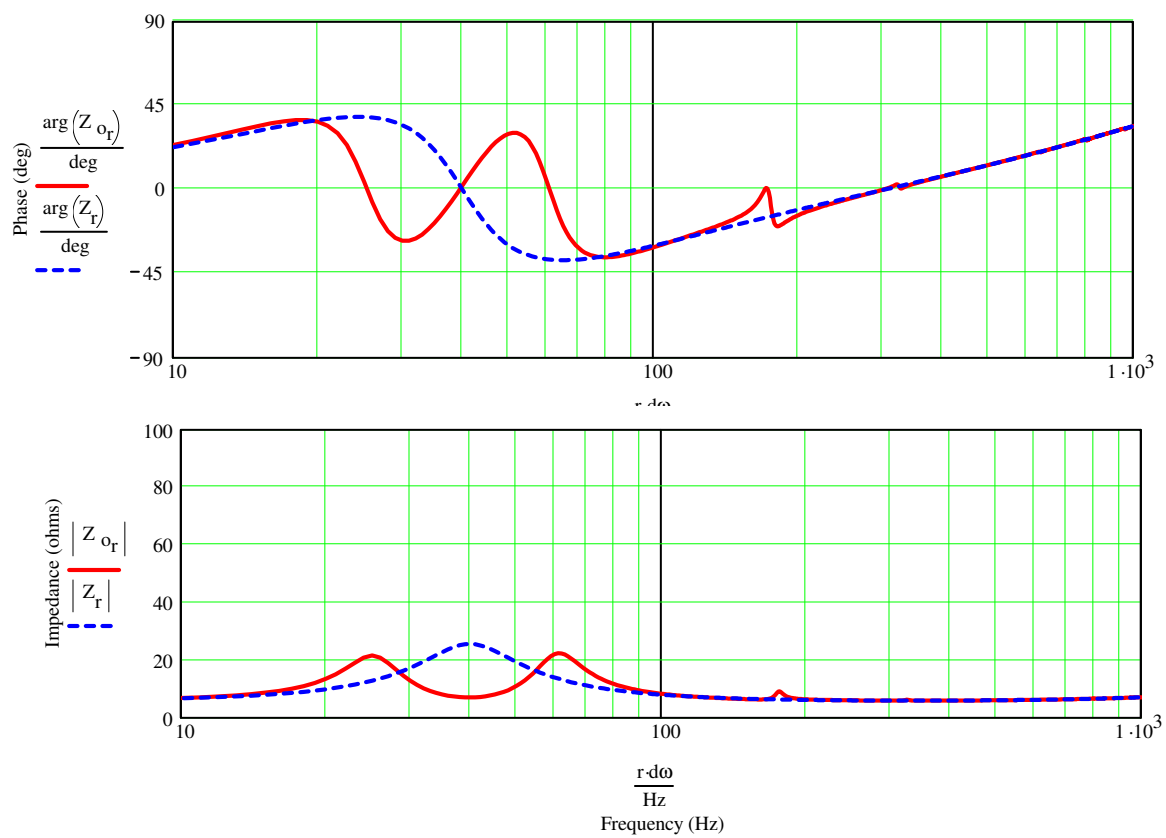
## Far Field Ported Box System and Infinite Baffle Sound Pressure Level Responses



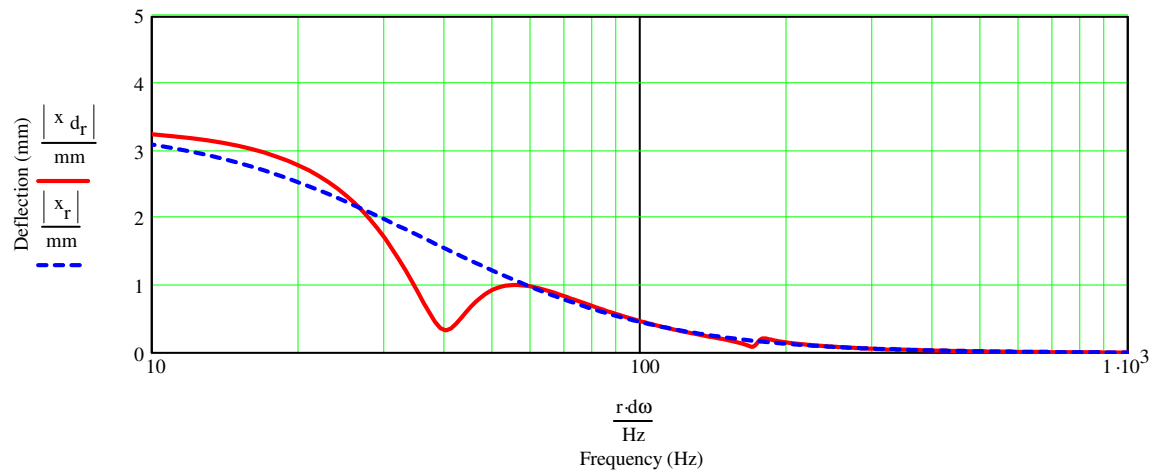
## Woofer and Terminus Far Field Sound Pressure Level Responses



## Ported Box System and Infinite Baffle Impedance



## Woofer Displacement



## System Time Response for an Impulse Input

