

Given

$$(1) V = \omega R = (V_L + V_R) / 2$$

$$(2) V_L = \omega (R + d_{mid})$$

$$\Rightarrow \omega_1 = V_L / (R + d_{mid}) \quad (1)$$

$$(3) V_R = \omega (R - d_{mid})$$

$$\Rightarrow \omega_2 = V_R / (R - d_{mid}) \quad (2)$$

From (1) + (2) sub ω_2 for ω_1

$$V_R / (R - d_{mid}) = V_L / (R + d_{mid})$$

$$\Rightarrow V_R = \frac{V_L (R - d_{mid})}{(R + d_{mid})} \quad (3) \quad (*)$$

From Given V , solve for V_L

$$(4) V = (V_L + V_R) / 2$$

$$\Rightarrow 2V = V_L + V_R$$

$$V_L = 2V - V_R \quad (4)$$

From (3) + (4) sub V_L from (4) for V_L in (3)

$$V_R = \frac{(2V - V_R)(R - d_{mid})}{(R + d_{mid})}$$

$$\Rightarrow V_R (R + d_{mid}) = (2V - V_R)(R - d_{mid}) \quad (*), (*)$$

$$\Rightarrow V_R R + V_R d_{mid} = 2V(R - d_{mid}) - V_R R + V_R d_{mid}$$

$$\frac{2V_R R}{2V_R R} = \frac{2V(R - d_{mid})}{2V(R - d_{mid})} \quad (5)$$

Solve for V_R in (5)

$$\frac{2V_R R}{2R} = \frac{2V(R - d_{mid})}{2R}$$

$$\Rightarrow V_R = \frac{V(R - d_{mid})}{R}$$