Important Doppler Effect and Wavelength Changes Formulas PDF

Formulas
Examples
with Units

List of 15
Important Doppler Effect and Wavelength Changes Formulas

1) Doppler Effect Formulas

1.1) Observed Frequency when Observer and Source Move Away from Each Other Formula

Evaluate Formula

Formula

$$F_o = \left(\frac{f_W \cdot \left(c - V_o \right)}{c + V_{source}} \right)$$

Example with Units

$$28.3688\,\text{Hz} = \left(\frac{200\,\text{Hz} \cdot \left(343\,\text{m/s} - 283\,\text{m/s} \right)}{343\,\text{m/s} + 80\,\text{m/s}} \right)$$

1.2) Observed Frequency when Observer and Source Move towards Each Other Formula

Evaluate Formula

Formula

$$F_o = \left(\frac{f_W \cdot \left(c + V_o \right)}{c - V_{source}} \right)$$

Example with Units

$$476.0456\,\text{Hz} = \left(\frac{200\,\text{Hz} \cdot \left(343\,\text{m/s} + 283\,\text{m/s} \right)}{343\,\text{m/s} - 80\,\text{m/s}} \right)$$

1.3) Observed Frequency when Observer Moves Away from Source Formula

Evaluate Formula

Formula

$$F_o = f_W \cdot \left(\frac{c - V_o}{c} \right)$$

Example with Units

$$34.9854\,\text{Hz} = 200\,\text{Hz} \cdot \left(\frac{343\,\text{m/s} - 283\,\text{m/s}}{343\,\text{m/s}} \right)$$

1.4) Observed Frequency when Observer Moves Away from Source using Wavelength Formula

Evaluate Formula

Formula

$$F_o = \frac{c - V_o}{\lambda}$$

Example with Units

$$150\,\text{Hz} = \frac{343\,\text{m/s} - 283\,\text{m/s}}{0.4\,\text{m}}$$

1.5) Observed Frequency when Observer Moves towards Source Formula

Evaluate Formula

Formula

$$F_o = \left(\frac{c + V_o}{c} \right) \cdot f_W$$

Example with Units

$$365.0146\,\text{Hz} = \left(\frac{343\,\text{m/s} + 283\,\text{m/s}}{343\,\text{m/s}} \right) \cdot 200\,\text{Hz}$$

1.6) Observed Frequency when Observer Moves towards Source and Source Moves Away Formula

Evaluate Formula

Formula

$$F_o = \left(\frac{c + V_o}{c + V_{source}} \right) \cdot f_W$$

Example with Units

$$295.9811\,\text{Hz} = \left(\frac{343\,\text{m/s} + 283\,\text{m/s}}{343\,\text{m/s} + 80\,\text{m/s}} \right) \cdot 200\,\text{Hz}$$

1.7) Observed Frequency when Observer Moves towards Source using Wavelength Formula

Evaluate Formula

Formula

$$F_o = \frac{c + V_o}{\lambda}$$

Example with Units

$$1565\,\text{Hz} = \frac{343\,\text{m/s} + 283\,\text{m/s}}{0.4\,\text{m}}$$

1.8) Observed Frequency when Source Moves Away from Observer Formula

Evaluate Formula

Formula

$$F_o = f_W \cdot \frac{c}{c + V_{source}}$$

Example with Units

$$162.1749\,\text{Hz} = 200\,\text{Hz} \cdot \frac{343\,\text{m/s}}{343\,\text{m/s} + 80\,\text{m/s}}$$

1.9) Observed Frequency when Source Moves towards Observer Formula

Evaluate Formula

Formula

$$F_o = f_W \cdot \frac{c}{c - V_{source}}$$

Example with Units

$$260.8365\,\text{Hz} = 200\,\text{Hz} \cdot \frac{343\,\text{m/s}}{343\,\text{m/s} - 80\,\text{m/s}}$$

1.10) Observed Frequency when Source Moves towards Observer and Observer Moves Away Formula

Evaluate Formula

Formula

$$F_o = \left(\frac{f_W \cdot \left(c - V_o \right)}{c - V_{source}} \right)$$

Example with Units

$$45.6274\,\text{Hz} = \left(\frac{200\,\text{Hz} \cdot \left(343\,\text{m/s} - 283\,\text{m/s} \right)}{343\,\text{m/s} - 80\,\text{m/s}} \right)$$

2) Wavelength Changes Formulas

2.1) Change in Wavelength due to Movement of Source Formula

Evaluate Formula

Formula

$$\lambda = V_{source} \cdot T_W$$

Example with Units

$$0.4\,\text{m} = 80\,\text{m/s} \cdot 0.005\,\text{s}$$

2.2) Change in Wavelength given Angular Frequency Formula

Evaluate Formula

Formula

$$\lambda = 2 \cdot \pi \cdot V_{source} \cdot \omega_f$$

Example with Units

$$0.4021\,\text{m} = 2 \cdot 3.1416 \cdot 80\,\text{m/s} \cdot 0.0008\,\text{Hz}$$

2.3) Change in Wavelength given Frequency Formula

Evaluate Formula

Formula

$$\lambda = \frac{V_{source}}{f_W}$$

Example with Units

$$0.4\,\text{m} = \frac{80\,\text{m/s}}{200\,\text{Hz}}$$

2.4) Effective Wavelength when Source Moves Away from Observer Formula

Evaluate Formula

Formula

$$\lambda_{effective} = \frac{c + V_{source}}{f_W}$$

Example with Units

$$2.115\,\text{m} = \frac{343\,\text{m/s} + 80\,\text{m/s}}{200\,\text{Hz}}$$

2.5) Effective Wavelength when Source Moves towards Observer Formula

Evaluate Formula

Formula

$$\lambda_{effective} = \frac{c - V_{source}}{f_W}$$

Example with Units

$$1.315\,\text{m} = \frac{343\,\text{m/s} - 80\,\text{m/s}}{200\,\text{Hz}}$$

Variables used in list of Doppler Effect and Wavelength Changes Formulas above

- **c** Velocity of Sound *(Meter per Second)*
- F_o Frequency Observed *(Hertz)*
- f_W Wave Frequency *(Hertz)*
- T_W Time Period of Progressive Wave *(Second)*
- V_o Velocity Observed *(Meter per Second)*
- V_{source} Velocity of Source *(Meter per Second)*
- **λ** Wavelength *(Meter)*
- $\lambda_{effective}$ Effective Wavelength *(Meter)*
- ω_f Angular Frequency *(Hertz)*

Constants, Functions, Measurements used in list of Doppler Effect and Wavelength Changes Formulas above

- constant(s): **pi**, 3.14159265358979323846264338327950288 *Archimedes' constant*
- Measurement: **Length** in Meter (m) *Length Unit Conversion*
- Measurement: **Time** in Second (s) *Time Unit Conversion*
- Measurement: **Speed** in Meter per Second (m/s) *Speed Unit Conversion*
- Measurement: **Frequency** in Hertz (Hz) *Frequency Unit Conversion*

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