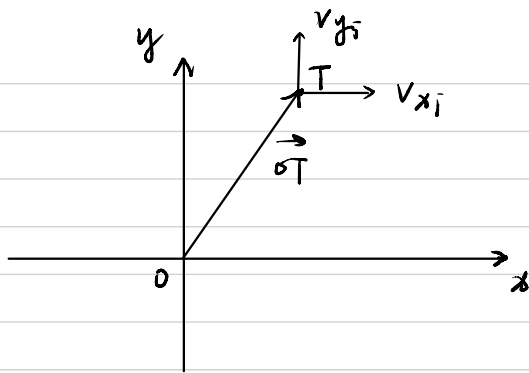


1.

O x_u, y_u unknown.T x_i, y_i known. v_{x_i}, v_{y_i} known.

$$\vec{OT} = (x_i - x_u, y_i - y_u)$$

需要知道 $\vec{v_i}$ 在 \vec{OT} 上的投影.

$$|\vec{v_i} \cdot \vec{OT}| = \frac{\vec{v_i} \cdot \vec{OT}}{|\vec{OT}|} = \frac{v_{x_i}(x_i - x_u) + v_{y_i}(y_i - y_u)}{\sqrt{(x_i - x_u)^2 + (y_i - y_u)^2}}$$

$$\text{设单位向量 } \vec{e_T} = \left(\frac{x_i - x_u}{\sqrt{(x_i - x_u)^2 + (y_i - y_u)^2}}, \frac{y_i - y_u}{\sqrt{(x_i - x_u)^2 + (y_i - y_u)^2}} \right)$$

$$\text{则对于多普勒效应 } f' = \left(\frac{v \pm v_o}{v \mp v_s} \right) f$$

$$\left\{ \begin{array}{l} f' = f_d(k+i) \quad i \in [0, N] \\ f = f_L \\ v = c \\ v_o = 0 \\ v_s = \vec{v_i} \cdot \vec{e_T} \end{array} \right.$$

$$f_d(k+i) = \frac{c}{c \mp |\vec{v_i} \cdot \vec{e_T}|} f_L$$

$$c \mp |\vec{v_i} \cdot \vec{e_T}| = \frac{c f_L}{f_d(k+i)}$$

$$\mp |\vec{v_i} \cdot \vec{e_T}| = \frac{c[f_L - f_d(k+i)]}{f_d(k+i)}$$

$$\frac{v_{x_i}(x_i - x_u) + v_{y_i}(y_i - y_u)}{\sqrt{(x_i - x_u)^2 + (y_i - y_u)^2}} = \frac{c[f_L - f_d(k+i)]}{f_d(k+i)}$$

用 $f_d(k), f_d(k+1) \dots f_d(k+N)$ 完成对 (x_u, y_u) 的估计.2. 同理 已知 $\vec{OT_0}, \vec{OT_1}, \vec{OT_2}$ $\Delta T_0, \Delta T_1$ 