

2.2 汽车燃料经济性的计算方法

1. 等速行驶工况燃料消耗量的计算

燃料消耗率 g_e : 万有特性图上的等燃料消耗率曲线

$$g_e = f(P_e, n) \Rightarrow b_e$$

$$P_e = \frac{1}{\eta_T} (F_f + F_i + F_w + F_j) \frac{u_a}{3600}$$
$$= \frac{1}{\eta_T} \left(mg\psi + \frac{C_D A u_a^2}{21.15} + \delta m \frac{du}{dt} \right) \frac{u_a}{3600}$$

$$\psi = f \cos\alpha + \sin\alpha$$

发动机功率 P_e , kW

Engine power output P_e , kW

发动机万有特性 (等高线)

Engine speed characteristics with constant specific fuel consumption

$g_e = \text{const}$
g/(kW·h)

汽油机 270~340 g/(kW·h)
柴油机 200~270 g/(kW·h)

发动机转速 n , r/min

Engine speed n , r/min

或汽车速度 u_a , km/h

MV velocity, km/h

单位时间油耗:

$$Q_t = \frac{P_e g_e / 3600}{\gamma \frac{1000}{9.81 \times 1000}} = \frac{P_e g_e}{367.1 \gamma}, \text{ mL/s}$$

$$\gamma = 6.96 \sim 7.15 \text{ N/L (汽油)} \Rightarrow \underline{7 \text{ N/L}}$$

$$\gamma = 7.94 \sim 8.13 \text{ N/L (柴油)} \Rightarrow \underline{8 \text{ N/L}}$$

$$\text{行程 } s \text{ 或 } t \text{ 油耗: } Q = \frac{P_e g_e s}{102 u_a \gamma} \quad \left(t = \frac{s}{u_a / 3.6} \right), \text{ mL}$$

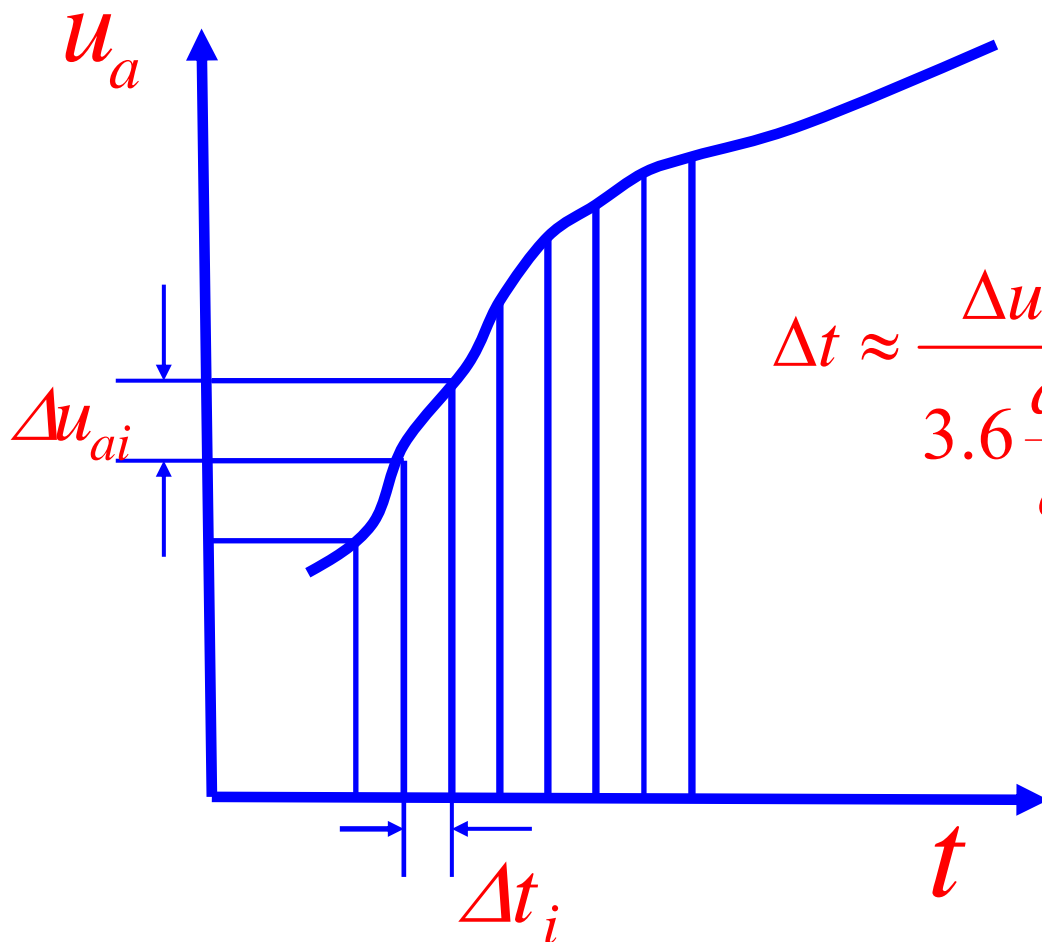
$$\text{单位行程油耗: } Q_s = \frac{P_e g_e}{1.02 u_a \gamma}, \text{ L / 100 km}$$

$$\frac{\text{mL}}{\text{m}} \longleftrightarrow \frac{\text{L}}{\text{km}}$$

2. 加速行驶工况燃料消耗量的计算

速度增量 $\Delta u_a = \text{const.}$

例如 $\Delta u_{ai} = \Delta u_a = 1 \text{ km/h}$



$$\Delta t \approx \frac{\Delta u_a}{3.6 \frac{du}{dt}} = \frac{1}{3.6 \frac{du}{dt}} = \frac{1}{3.6 a_j}$$

$$\Delta u_a = u_{ai} - u_{ai-1} = 1 \text{ km/h}$$

$$\Delta s_i = \frac{u_{ai}^2 - u_{ai-1}^2}{2 \times 3.6^2 \frac{du}{dt}} = \frac{\Delta u_a (u_{ai} + u_{ai-1})}{25.92 \frac{du}{dt}} = \frac{(u_{ai} + u_{ai-1})}{25.92 \frac{du}{dt}}$$

$$Q_i = \frac{1}{2} (Q_{ti} + Q_{ti-1}) \Delta t$$

$$Q = \sum Q_i$$

$$S = \sum \Delta S_i$$

$$Q_s = \frac{100 Q}{S}$$

3. 等减速行驶工况燃料消耗的计算

$$t = \frac{u_{ai} - u_{ai-1}}{3.6 \frac{du}{dt}} = \frac{\Delta u_a}{3.6 a_j} = \frac{1}{3.6 a_j}$$

$$Q_{de} = Q_{id} t$$

$$S_{de} = \frac{u_{ai}^2 - u_{ai-1}^2}{25.92 \frac{du}{dt}} = \frac{u_{ai} + u_{ai-1}}{25.92 a_j}$$

4. 怠速停车时的燃料消耗量

$$Q_{st} = Q_{id} t_s$$

mL → Q_{st} mL/s → Q_{id}

5. 整个循环工况的百公里燃料消耗量

$$Q_s = \frac{100 \sum Q}{\sum s}$$

L/100km → Q_s $\frac{\text{mL}}{\text{m}} \leftrightarrow \frac{\text{L}}{\text{km}}$

$\sum Q$ 整个行驶循环过程的总油耗量

$\sum s$ 整个行驶循环过程的总路程