Quiz 5

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1. (a)

$$V_0 = \oint_C (u \times B) \cdot dl$$
$$= \int_2^{1'} (\hat{x} u \times \hat{z} B_0) \cdot (\hat{y} dl)$$
$$= -u B_0 h \quad (V)$$

(b) $P = I^2 R$, $I = \frac{V_0}{R} = \frac{-uB_0h}{R} \Rightarrow P = \frac{u^2 B_0^2 h^2}{R}$ (W)

(c) The mechanic power: $P = F \cdot u$

The magnetic force: $F = I \cdot \oint_C dl \times B = I \cdot \int_{2'}^{1'} dl \times B = -\hat{x} I B_0 h$

since $I = -\frac{uB_0h}{R} \Rightarrow F = \hat{x} \cdot \frac{uB_0^2h^2}{R}$

$\Rightarrow P = F \cdot u = \frac{u^2 B_0^2 h^2}{R}$ which is the same as what calculated in (b)

2. ① $\nabla \times E' = \eta \nabla \times H = \eta \cdot j\omega\epsilon E = -j\omega\mu(-\frac{E}{\eta}) = -j\omega\mu H'$

② $\nabla \times H' = -\frac{1}{\eta} \nabla \times E = \frac{1}{\eta} j\omega\mu H = j\omega\epsilon\eta \cdot H = j\omega\epsilon E'$

③ $\nabla \cdot E' = \eta \cdot \nabla H = 0$

④ $\nabla \cdot H = -\frac{1}{\eta} \nabla E = 0$

Therefore, the four equations also holds for $(E', H') \Rightarrow (E', H')$ is also the solution.