Problem 4.10

By definition, the instantaneous frequency f_i is related to the phase $\theta(t)$ as

$$f_i = \frac{1}{2\pi} \frac{d\theta}{dt}$$

which may be rewritten as

$$f_i \approx \frac{1}{2\pi} \frac{\Delta\theta}{\Delta t} \tag{1}$$

where $\Delta\theta$ and Δt are small changes in the phase $\theta(t)$ and time t. We are given

$$\theta(t + \Delta t) - \theta(t) = \pi$$

from which we infer that

$$\Delta\theta = \pi \tag{2}$$

Substituting Eq. (2) into (1) yields

$$f_i \approx \frac{1}{2\pi} \cdot \frac{\Delta\theta}{\Delta t} = \frac{1}{2\Delta t}$$

which is the desired result.

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