

# **Noncoherent Binary FSK: NC-BFSK**

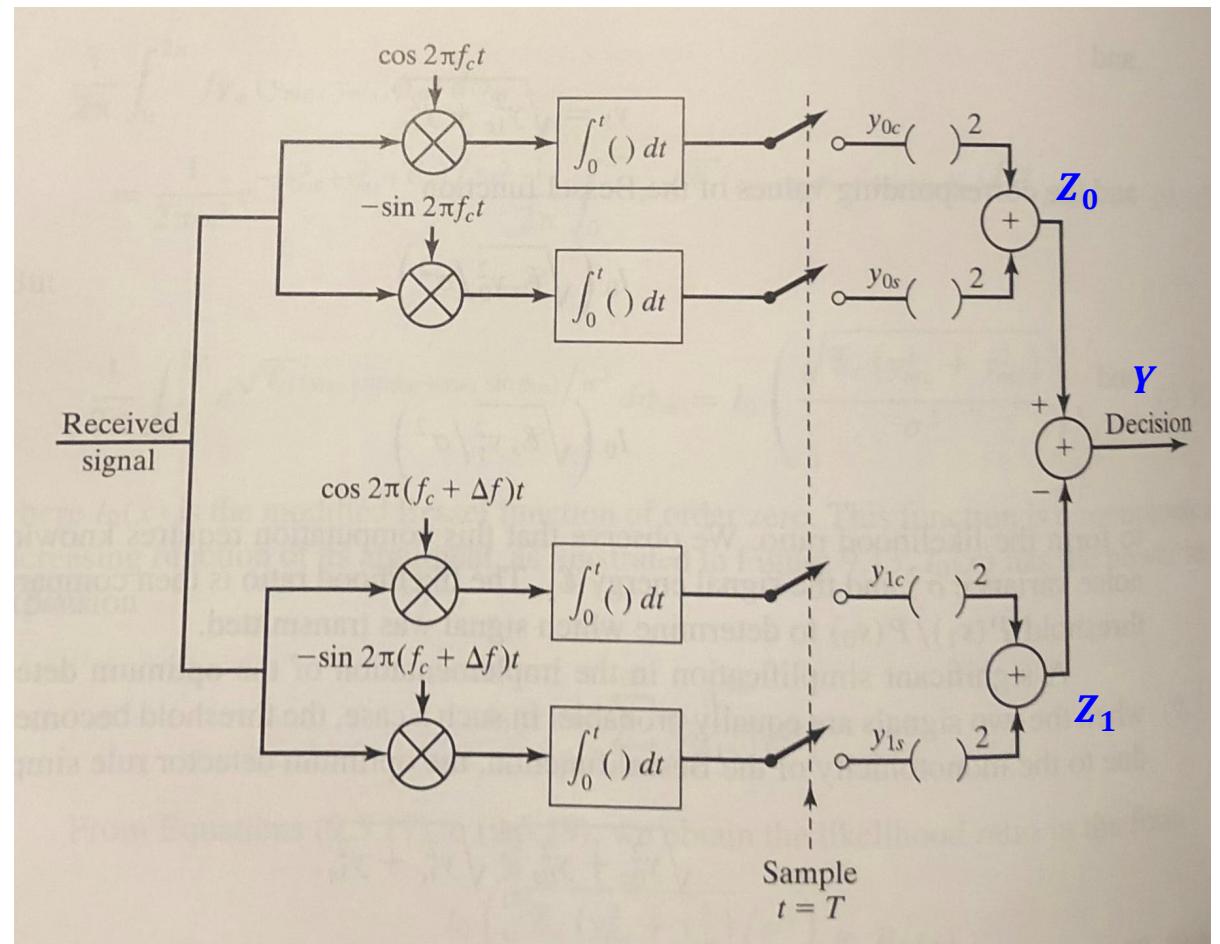
EE161: Digital Communication Systems  
San Jose State University



# Noncoherent BFSK receiver

$$r(t) = \sqrt{E_s} \cos(2\pi f_i t + \varphi)$$

$$f_i = \begin{cases} f_c, & i = B = 0 \\ f_c + \Delta f, & i = B = 1 \end{cases}$$



## Metrics and decision rule

- The scheme works since (“wipe out the phase”):

$$Z_i = y_{ic}^2 + y_{is}^2 = (\sqrt{E_s} \cos \varphi)^2 + (\sqrt{E_s} \sin \varphi)^2 = E_s, \quad i = 0, 1$$

- Decision metric:  $Y = Z_0 - Z_1$
- Decision rule:

$$\hat{B} = \begin{cases} 0, & Y > 0 \ (Z_0 > Z_1), \\ 1, & Y \leq 0 \ (Z_0 \leq Z_1). \end{cases}$$

# NC-FSK performance

- AWGN:

$$P_b = \frac{1}{2} e^{-E_s/2N_0}$$

- Flat Rayleigh fading:  $\rho_0 = \frac{E_s}{N_0} E\{A^2\}$

$$P_b = \frac{1}{2 + \rho_0}$$

