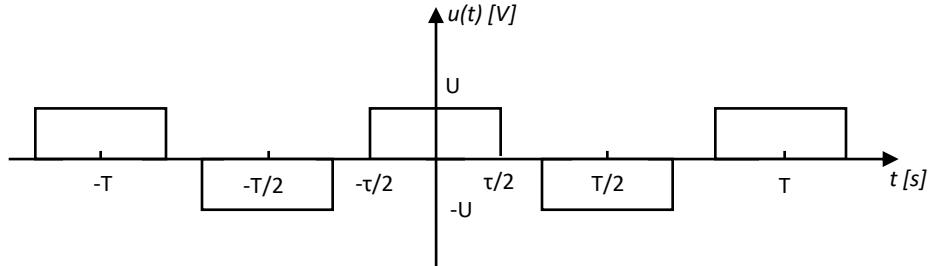


1. a) Izvesti izraz za koeficijente Furijeovog reda u kompleksnom obliku za povorku pravougaonih impulsa amplitude  $U$ , perioda  $T$  i trajanja  $\tau$ .

b) Odrediti koeficijente Furijeovog reda u eksponencijalnom obliku za signal čiji je vremenski dijagram prikazan na slici 1.



slika 1

c) Za signal prikazan na slici 1 skicirati amplitudski spektar za  $T=1$ ,  $\tau=0.2$  i  $U=1$ .

Rješenje:

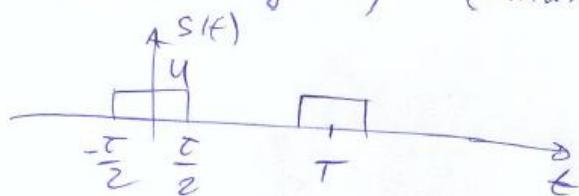
1. zadatak

$$\begin{aligned}
 a) f_n &= \frac{1}{T} \int_{-\frac{T}{2}}^{\frac{T}{2}} s(t) e^{-jn\omega_0 t} dt = \frac{1}{T} \int_{-\frac{T}{2}}^{\frac{T}{2}} s(t) e^{-jn\omega_0 t} dt \\
 &= \frac{1}{T} \int_{-\frac{T}{2}}^{\frac{T}{2}} U e^{-jn\omega_0 t} dt = \frac{1}{T} \int_{-\frac{T}{2}}^{\frac{T}{2}} U (\cos n\omega_0 t - j \sin n\omega_0 t) dt \\
 &\quad - j \sin n\omega_0 t dt = \frac{U}{T} \int_{-\frac{T}{2}}^{\frac{T}{2}} \cos n\omega_0 t dt - \frac{jU}{T} \int_{-\frac{T}{2}}^{\frac{T}{2}} \sin n\omega_0 t dt \\
 &= \frac{2U}{T} \int_0^{\frac{T}{2}} \cos n\omega_0 t dt = \frac{2U}{T} \frac{\sin n\omega_0 t}{n\omega_0} \Big|_0^{\frac{T}{2}} ; n \neq 0 \\
 &= \frac{2U}{T} \frac{\sin \frac{n\omega_0 T}{2}}{n\omega_0 \cdot \frac{T}{2}} = \frac{U \cdot \tilde{\omega}}{T} \frac{\sin \frac{n\omega_0 T}{2}}{\frac{n\omega_0 T}{2}} ; \tilde{\omega} = \frac{2\pi}{T}
 \end{aligned}$$

$$\begin{aligned}
 f_0 &= \frac{1}{T} \int_{-\frac{T}{2}}^{\frac{T}{2}} s(t) dt = \frac{1}{T} \cdot U \cdot \tilde{\omega} = \frac{U \cdot \tilde{\omega}}{T} \\
 \text{Imaća je } f_n &= \frac{U \cdot \tilde{\omega}}{T} \frac{\sin \frac{n\omega_0 T}{2}}{\frac{n\omega_0 T}{2}} ; \omega_n = \frac{n\omega_0 T}{2} \quad (10)
 \end{aligned}$$

b)

b) ako je s(t) naborka periodičkih  
impulsa uog a) (amplituda u)

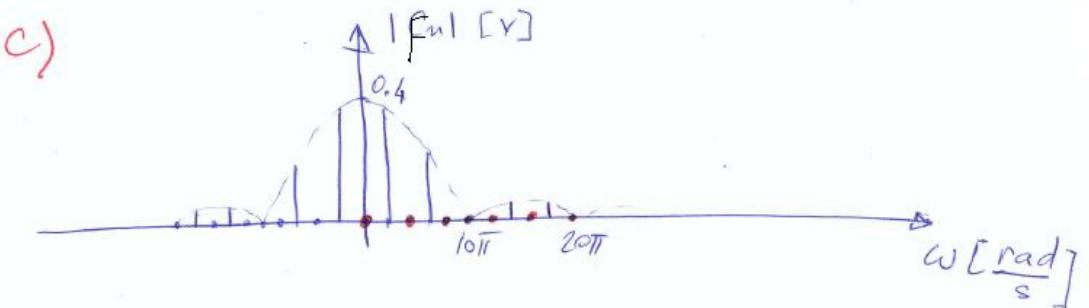


$$u(t) = s(t) - s(t - \frac{T}{2}) \quad T > 2$$

$$\begin{aligned} f_n &= f_{n1} - f_{n1} e^{-jnw_0 \cdot \frac{T}{2}} \\ &= f_m \left( 1 - e^{-j\pi \cdot \frac{2\pi}{T} \cdot \frac{T}{2}} \right) \quad (\text{kao uvećanje, potreban je na visezadama}) \\ &= f_{n1} \left( 1 - e^{-j\pi} \right) = f_{n1} (1 - (-1)^n) \quad (\text{koristi direktno u formuli}) \\ &= \begin{cases} 2f_{n1}, & \text{u neparno} \\ 0, & \text{u parno} \end{cases} \end{aligned}$$

15

c)



$$\frac{\pi \cdot 2}{T} = 0.2$$

10

Postoji samo konjugatne na  $\sqrt{2}$  amplitudine  $(2k+1) \frac{2\pi}{T}$