Közérdekű közlemény

A doksi teljesen Wolfram-ready, esetleg Wolfram Cloud kellhet hozzá.

1. feladat

Egy rendszer az alábbi állapottér reprezentációval adott:

$$\underline{x}' = \begin{bmatrix} -0.9492 & 0.4328 \\ -0.0738 & -0.2508 \end{bmatrix} \underline{x} + \begin{bmatrix} -7.1 \\ 15.0 \end{bmatrix} u$$

$$y = \begin{bmatrix} 13.0 & 19.9 \end{bmatrix} \underline{x} + 0u$$

1. Adja meg a rendszer leírását irányíthatósági alakú állapottér reprezentációban!

2. Adja meg a rendszer leírását megfigyelhetőségi alakú állapottér reprezentációban!

3. Adja meg a rendszer leírását diagonális alakú állapottér reprezentációban! (A diagonális állapottér reprezentáció nem egyértelmű, a feladatban a transzformációs mátrix alapú megoldást alkalmazza!)

A számoláshoz használt sajátértékek:

Házi helper kidobja.

Részben helyes válasz.

A correct answer is $\begin{bmatrix} -1.2 & -0.27 \\ 1.0 & 0 \end{bmatrix}$.

A correct answer is $\begin{bmatrix} 1.0 \\ 0 \end{bmatrix}$.

A correct answer is $\begin{bmatrix} 206.2 & 355.010562 \end{bmatrix}$.

A correct answer is $\begin{bmatrix} -1.2 & 1.0 \\ -0.27 & 0 \end{bmatrix}$.

A correct answer is $\begin{bmatrix} 206.2 \\ 355.010562 \end{bmatrix}$.

A correct answer is $\begin{bmatrix} 1.0 & 0 \end{bmatrix}$.

A correct answer is $\begin{bmatrix} -0.899999999999 & 0 \\ 0 & -0.3 \end{bmatrix}$.

A correct answer is $\begin{bmatrix} -1.66666666666 \\ 1.66666666666 \end{bmatrix}$.

A correct answer is $\begin{bmatrix} 3861.13843 & 6212.13300003 \end{bmatrix}$.

A correct answer is -0.9, which can be typed in as follows: `-0.9`

A correct answer is -0.3, which can be typed in as follows: `-0.3`

2. feladat

Adott egy rendszer az alábbi állapotváltozós leírással:

$$\underline{\dot{x}} = \begin{bmatrix} 9 & -6 \\ 6 & 7 \end{bmatrix} \underline{x} + \begin{bmatrix} -2 \\ -5 \end{bmatrix} u$$
$$y = \begin{bmatrix} -3 & 5 \end{bmatrix} \underline{x} + (10) u$$

1. Adja meg a rendszer irányíthatósági és megfigyelhetőségi mátrixát!

cT * A = (-3; 5) * ((9; -6); (6; 7)) = (-3 * 9 + 5 * 6; -3 * (-6) + 5 * 7) = (3; 53)
M_0 = (C^T; C^T * A) = ((-3 ; 5); (3; 53))

A * B =

		-2	
		(-5)	
9	-6	9 * (-2) + (-6) * (-5)	12
(6	7) =	(6 * (-2) + 7 * (-5)	) = (-47)

M_C = (B; A * B) =

-2	12	
(-5	-47	) = ((-2; 12); (-5; -47))

2. Döntse el, hogy a rendszer irányítható-e illetve megfigyelhető-e!

det M_0 ≠ 0 ⇒ megfigyelhető
det M_C ≠ 0 ⇒ irányítható

Helyes válasz.

A correct answer is $\begin{bmatrix} -3 & 5 \\ 3 & 53 \end{bmatrix}$.

A correct answer is $\begin{bmatrix} -2 & 12 \\ -5 & -47 \end{bmatrix}$.

A correct answer is **true**.

A correct answer is **true**.

3. feladat

Adott az alábbi diszkrét idejű rendszer állapotváltozós leírása:

$$\underline{x}[k+1] = \begin{bmatrix} 1.7374 & -9.0991 \\ 0.5421 & -0.301 \end{bmatrix} \underline{x}[k] + \begin{bmatrix} -8.7 \\ 8.6 \end{bmatrix} u$$
$$y[k] = \begin{bmatrix} 5.6 & -18.5 \end{bmatrix} \underline{x}[k] + (-4.7) u$$

1. A rendszer sajátértékei alapján határozza meg, hogy a rendszer aszimptotikusan stabilis-e?

Jóbarátunk, [házi helper]:
lambda1 = 0.7182 - 1.9733 * j
lambda2 = 0.7182 + 1.9733 * j
sehogy nem stabil

2. Amennyiben nem aszimptotikusan stabil a rendszer állapot visszacsatolással tegye stabillá a rendszert! Az előírt sajátértékek: $\lambda_1 = -0.5$ és $\lambda_2 = 0.8$. Adja meg a visszacsatoló $\underline{K^T}$ vektor értékét!

$$A * B = \begin{pmatrix} 1.7374 & -9.0991 \\ 0.5421 & -0.301 \end{pmatrix} * \begin{pmatrix} -8.7 \\ 8.6 \end{pmatrix} = \begin{pmatrix} 1.7374 * (-8.7) + (-9.0991) * 8.6 \\ 0.5421 * (-8.7) + (-0.301) * 8.6 \end{pmatrix} = \begin{pmatrix} -93.36764 \\ -7.30487 \end{pmatrix}$$

$$M_C = (B; A * B) = \begin{pmatrix} -8.7 & -93.36764 \\ 8.6 & -7.30487 \end{pmatrix} = ((-8.7; -93.36764); (8.6; -7.30487))$$

$$M_C \text{ inverz} = \begin{pmatrix} -0.00843 & 0.10775 \\ -0.00992 & -0.01004 \end{pmatrix}$$

fi(lambda) = (lambda + 0.5) * (lambda - 0.8) = lambda^2 - 0.3 * lambda - 0.4
A = ((1.7374; -9.0991); (0.5421; -0.301))
A^2 = ((1.7374 * 1.7374 - 9.0991 * 0.5421, 1.7374 * (-9.0991) - 9.0991 * (-0.301)), (0.5421 * 1.7374 - 0.301 * 0.5421, 0.5421 * (-9.0991) - 0.301 * (-0.301))) =
((-1.91406335, -13.06994724), (0.77867244, -4.84202111))
0.3 * A = ((0.52122, -2.72973), (0.16263, -0.0903))
fi(A) = A^2 - 0.3 * A - 0.4 * E = ((-1.91406335, -13.06994724), (0.77867244, -4.84202111)) - ((0.52122, -2.72973), (0.16263, -0.0903)) - ((0.4; 0); (0; 0.4)) =
((-2.83528; -10.3402); (0.616042; -5.15172))

$$K^T = (0;1) * M_C^{-1} * fi(A) = (-0.00992; -0.01004) * \begin{pmatrix} -2.83528 & -10.3402 \\ 0.616042 & -5.15172 \end{pmatrix} = (-0.00992 * (-2.83528) + (-0.01004) + 0.616042; -0.00992 * (-10.3402) + (-0.01004) * (-5.15172)) =$$
(0.6341279776; 0.1542980528)

Részben helyes válasz.

A correct answer is $-7.48813785362E-11 \cdot (2.6352144986E+10 \cdot \mathrm{j} - 9.591169581E+9)$, which can be typed in as follows:
`-7.48813785362E-11*(2.6352144986E+10*%i-9.591169581E+9)`

A correct answer is $7.48813785362E-11 \cdot (2.6352144986E+10 \cdot \mathrm{j} + 9.591169581E+9)$, which can be typed in as follows:
`7.48813785362E-11*(2.6352144986E+10*%i+9.591169581E+9)`

A correct answer is **false**.

A correct answer is $[0.0219544819579 \quad 0.154349301515]$.

A correct answer is $\begin{bmatrix} -8.7 & -93.36764 \\ 8.6 & -7.30486999999 \end{bmatrix}$.

A correct answer is $\begin{bmatrix} -0.00843018045247 & 0.10775086396 \\ -0.00992482438308 & -0.0100402293177 \end{bmatrix}$.

A correct answer is $\begin{bmatrix} -2.83528335 & -10.34021724 \\ 0.61604244 & -5.15172111 \end{bmatrix}$.

4. feladat

Adott egy folytonos idejű rendszer az alábbi állapotváltozós leírással:

$$\underline{x}'(t) = \begin{bmatrix} -19.2115 & -41.2557 \\ 1.7328 & -15.9885 \end{bmatrix} \underline{x}(t) + \begin{bmatrix} 6.6 \\ 7.3 \end{bmatrix} u(t)$$

$$y(t) = \begin{bmatrix} -15.6 & 19.3 \end{bmatrix} \underline{x}(t) + (13.3) u(t)$$

Számítsa ki és adja meg a b_0, b_1, b_2, a_0, a_1 és a_2 paraméterek értékét a rendszer átviteli karakterisztikájának normál alakjában:

$$H(j\omega) = \frac{b_0 (j\omega)^2 + b_1 (j\omega) + b_2}{a_0 (j\omega)^2 + a_1 (j\omega) + a_2}$$

H(j * omega) = C^T * [j * omega * E - A] inverz * B + D
de amúgy
TransferFunctionModel[StateSpaceModel[{{{-19.2115, -41.2557}, {1.7328, -15.9885}}, {{6.6}, {7.3}}, {{-15.6, 19.3}}, {{13.3}}}, SamplingPeriod -> None]] oszt Expand

```
TransferFunctionModel[( -19.2115  -41.2557 | 6.6 )
                      (  1.7328   -15.9885 | 7.3 )   S ]
                      ( -15.6      19.3    | 13.3 )
```

$$\left(\frac{6358.11 + 73.13\,\dot{s} + \dot{s}^2 + 12.3\,\left(378.651 + 35.2\,\dot{s} + \dot{s}^2\right)}{378.651 + 35.2\,\dot{s} + \dot{s}^2}\right)^{\mathcal{T}}$$

$$\text{TransferFunctionExpand}\left[\left(\frac{6358.11 + 73.13\,\dot{s} + \dot{s}^2 + 12.3\,\left(378.651 + 35.2\,\dot{s} + \dot{s}^2\right)}{378.651 + 35.2\,\dot{s} + \dot{s}^2}\right)^{\mathcal{T}}\right]$$

$$\left(\frac{11015.5 + 506.09\,\dot{s} + 13.3\,\dot{s}^2}{378.651 + 35.2\,\dot{s} + \dot{s}^2}\right)^{\mathcal{T}}$$

Helyes válasz.

A correct answer is 13.3, which can be typed in as follows: `13.3`

A correct answer is 506.09, which can be typed in as follows: `506.09`

A correct answer is 11015.5130196, which can be typed in as follows: `11015.5130196`

A correct answer is 1, which can be typed in as follows: `1`

A correct answer is 35.2, which can be typed in as follows: `35.2`

A correct answer is 378.65094471, which can be typed in as follows: `378.65094471`

5. feladat

Adott egy diszkrét idejű rendszer az alábbi állapotváltozós leírással:

$$\underline{x}[k+1] = \begin{bmatrix} 0.4399 & -0.6266 \\ 0.0599 & -0.5399 \end{bmatrix} \underline{x}[k] + \begin{bmatrix} 28.3 \\ -17.4 \end{bmatrix} u[k]$$

$$y[k] = \begin{bmatrix} -32.6 & 36.6 \end{bmatrix} \underline{x}[k] + (-16.9) u[k]$$

Számítsa ki és adja meg a b_0, b_1, b_2, a_1, a_2 paraméterek értékét a rendszer átviteli karakterisztikájának normál alakjában:

$$H(e^{j\vartheta}) = \frac{b_0 + b_1 e^{-j\vartheta} + b_2 e^{-2j\vartheta}}{1 + a_1 e^{-j\vartheta} + a_2 e^{-2j\vartheta}}$$

TransferFunctionModel[StateSpaceModel[{{{0.4399, -0.6266}, {0.0599, -0.5399}}, {{28.3}, {-17.4}}, {{-32.6, 36.6}}, {{-16.9}}}, SamplingPeriod -> None]] oszt Expand

$$\text{TransferFunctionModel}\left[\left(\begin{array}{cc|c} 0.4399 & -0.6266 & 28.3 \\ 0.0599 & -0.5399 & -17.4 \\ \hline -32.6 & 36.6 & -16.9 \end{array}\right)^{\mathcal{S}}\right]$$

$$\left(\frac{-511.544-1559.32\,\dot{s}+\dot{s}^2-17.9\left(-0.199969+0.1\,\dot{s}+\dot{s}^2\right)}{-0.199969+0.1\,\dot{s}+\dot{s}^2}\right)^{\mathcal{T}}$$

$$\text{TransferFunctionExpand}\left[\left(\frac{-511.544-1559.32\,\dot{s}+\dot{s}^2-17.9\left(-0.199969+0.1\,\dot{s}+\dot{s}^2\right)}{-0.199969+0.1\,\dot{s}+\dot{s}^2}\right)^{\mathcal{T}}\right]$$

$$\left(\frac{-507.965-1561.11\,\dot{s}-16.9\,\dot{s}^2}{-0.199969+0.1\,\dot{s}+\dot{s}^2}\right)^{\mathcal{T}}$$

A correct answer is -16.9, which can be typed in as follows: `-16.9`

A correct answer is -1561.11, which can be typed in as follows: `-1561.11`

A correct answer is -511.978701446, which can be typed in as follows: `-511.978701446`

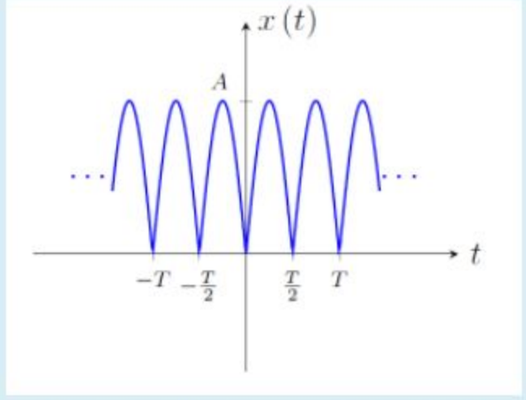
A correct answer is 0.1, which can be typed in as follows: `0.1`

A correct answer is -0.19996867, which can be typed in as follows: `-0.19996867`

6. feladat

Adott az alábbi T periódus idejű periodikus jel:

$x(t) = A \cdot |sin(\frac{2\pi}{T}t)|$



Az ábrán feltüntetett paraméterek értékei: $A = 1.7$.

Számolja ki a jel Fourier-polinómjának első három nem nulla értékű együtthatóját!

a_0 = 2 * A / pi = 2 * 1.7 / pi = 1.08225
a_n = (-4 * A) / (pi * (4 * n^2 - 1)) = -6.8 / (pi * (4 * n^2 - 1))
a_1 = -6.8 / (pi * (4 * 1^2 - 1)) = -0.72150240868
a_2 = -6.8 / (pi * (4 * 2^2 - 1)) = -0.14430048173

Helyes válasz.

A correct answer is $\frac{3.4}{\pi}$, which can be typed in as follows: `3.4/%pi`

A correct answer is $-\frac{2.26666666666}{\pi}$, which can be typed in as follows: `-2.26666666666/%pi`

A correct answer is $-\frac{0.453333333333}{\pi}$, which can be typed in as follows: `-0.453333333333/%pi`

7. feladat

Egy diszkrét idejű periodikus jel egy periódusának értékei az alábbiak:

$$x[0] = -0.8, x[1] = 0.5, x[2] = 0.9, x[3] = 1.5,$$
$$x[4] = -6.2, x[5] = 5.7, x[6] = 5.1, x[7] = 6.8$$

Adja meg a jel komplex Fourier-sorának 4. harmónikushoz tartozó komplex együtthatóját!

p = 4, L = 8, M = pi / 4

U_4^C = 1 / L * (sum x[k] * e^(-i * p * M * k)) = 1 / 8 * (sum x[k] * e^(-i * pi * k))

U_4^C = 1/8 * (-0.8 * e^(-i*pi*0) + 0.5 * e^(-i*pi*1) + 0.9 * e^(-i*pi*2) + 1.5 * e^(-i*pi*3) - 6.2 * e^(-i*pi*4) + 5.7 * e^(-i*pi*5) + 5.1 * e^(-i*pi*6) + 6.8 * e^(-i*pi*7)) = -1.9375

A correct answer is -1.9375, which can be typed in as follows: `-1.9375`

8. feladat

Egy folytonos idejű rendszer átviteli karakterisztikája a következő alakban adott:

$$H(j\omega) = \frac{-10 \cdot j\omega + 6}{(j\omega)^2 + 9 \cdot j\omega + 8}$$

A rendszert az alábbi jel gerjeszti:

$$u(t) = 1 + 9cos(3t) + 2cos(6t)$$

1. Határozza meg az átviteli tényező értékeit a válasz kiszámításához szükséges körfrekvenciákon! $(\omega_0 < \omega_1 < \omega_2)$

U_0 = 1, U_1 = 9, U_2 = 2, $omega_1$ = 3, $omega_2$ = 6

H(i * omega) = (-10 * i * omega + 6) / ((i * omega)^2 + 9 * i * omega + 8)

H_0 = H(i * 0) = 6 / 8 = 0.75

H_1 = H(i * 3) = (-10 * i * 3 + 6) / ((i * 3)^2 + 9 * i * 3 + 8) = 1.13234 + e^-2.98121435 = -1.1178 - 0.18082 * j

H_2 = H(i * 6) = (-10 * i * 6 + 6) / ((i * 6)^2 + 9 * i * 6 + 8) = 0.991314 + e^2.76290857 = -0.921081 + 0.366486 * j

2. Határozza meg a rendszer válaszának időfüggvényét a megadott gerjesztésre, ha a választ az alábbi alakban keressük:

$$y(t) = Y_0 + Y_1 \cdot cos(3t + \varphi_1) + Y_2 \cdot cos(6t + \varphi_2)$$

Y_0 = H_0 * U_0 = 0.75 * 1 = 0.75

Y_1 = H_1 (alap) * U_1 = 1.13234 * 9 = 10.19106

Y_2 = H_2 (alap) * U_2 = 0.991314 * 2 = 1.982628

fi_1 = H_1 (exponens) = -2.98121435

fi_2 = H_2 (exponens) = 2.76290857

Helyes válasz.

A correct answer is $\frac{3}{4}$, which can be typed in as follows: `3/4`

A correct answer is $\frac{6-30 \cdot j}{27 \cdot j-1}$, which can be typed in as follows: `(6-30*%i)/(27*%i-1)`

A correct answer is $\frac{6-60 \cdot j}{54 \cdot j-28}$, which can be typed in as follows: `(6-60*%i)/(54*%i-28)`

A correct answer is $\frac{3}{4}$, which can be typed in as follows: `3/4`

A correct answer is $\frac{54 \cdot \sqrt{26}}{\sqrt{730}}$, which can be typed in as follows: `(54*sqrt(26))/sqrt(730)`

A correct answer is $\mathrm{atan}\,(27) - \mathrm{atan}\,(5) + \pi$, which can be typed in as follows: `atan(27)-atan(5)+%pi`

A correct answer is $\frac{6 \cdot \sqrt{101}}{5 \cdot \sqrt{37}}$, which can be typed in as follows: `(6*sqrt(101))/(5*sqrt(37))`

A correct answer is $-\mathrm{atan}\,(10) + \mathrm{atan}\,\left(\frac{27}{14}\right) + \pi$, which can be typed in as follows: `(-atan(10))+atan(27/14)+%pi`

9. feladat

$$H(e^{j\theta}) = \frac{-3.26e^{j\theta}+(4.74)}{e^{j2\theta}+(0.4)e^{j\theta}+0.0}$$

A rendszert a következő jel gerjeszti:

$$u[k] = 2.3 + (-9.4)cos\left(\frac{\pi}{6}k + (-1.86)\right) + (-9.9)cos\left(\frac{\pi}{3}k + (-2.62)\right) + (-0.8)cos\left(\pi k + (-1.0)\right)$$

1. Adja meg a periodikus gerjesztés periódusszámát!

Venni kell a π-s dolgok periódusát (hányada a 2π-nek), majd LKKT(12, 6, 2) = 12, Wolframban amúgy LCM

2. Határozza meg az átviteli tényező értékeit a válasz kiszámításához szükséges körfrekvenciákon! $(\Theta_0 < \Theta_1 < \Theta_2 < \Theta_3)$

H(e^(j * theta)) = (-3.26 * e^(i * theta) + 4.74) / (e^(i * 2 * theta) + 0.4 * e^(i * theta))
$Theta_0$ = 0, H_0 = (-3.26 * e^(0) + 4.74) / (e^(0) + 0.4 * e^(0)) = 1.05714
$Theta_1$ = pi / 6, H_1 = (-3.26 * e^(i * pi / 6) + 4.74) / (e^(i * 2 * pi / 6) + 0.4 * e^(i * pi / 6)) = 1.84848 + e^-1.60446 = -0.0622071 - 1.84743 * j
$Theta_2$ = pi / 3, H_2 = (-3.26 * e^(i * pi / 3) + 4.74) / (e^(i * 2 * pi / 3) + 0.4 * e^(i * pi / 3)) = 3.36296 + e^-2.5505 = -2.79231 - 1.87417 * j
$Theta_3$ = pi, H_3 = (-3.26 * e^(i * pi) + 4.74) / (e^(i * 2 * pi) + 0.4 * e^(i * pi)) = 13.333333

3. Határozza meg a rendszer válaszának időfüggvényét a megadott gerjesztésre, ha a választ az alábbi alakban keressük:

$$y[k] = Y_0 + Y_1cos(N_1\frac{\pi}{6}k + X_1) + Y_2cos(N_2\frac{\pi}{6}k + X_2) + Y_3cos(N_3\frac{\pi}{6}k + X_3)$$

N_1 = 1, N_2 = 2, N_3 = 6
U_0 = 2.3, U_1 = -9.4 * e^(i * -1.86), U_2 = -9.9 * e^(i * -2.62), U_3 = -0.8 * e^(i * -1)
Y_0 = H_0 * U_0 = 1.05714 * 2.3 = 2.431422
H_n * U_n = Y_n + e^(X_n)
H_1 * U_1 = ((-3.26 * e^(i * pi / 6) + 4.74) / (e^(i * 2 * pi / 6) + 0.4 * e^(i * pi / 6))) * -9.4 * e^(i * -1.86) = 17.3757 + e^-0.32286
H_2 * U_2 = ((-3.26 * e^(i * pi / 3) + 4.74) / (e^(i * 2 * pi / 3) + 0.4 * e^(i * pi / 3))) * -9.9 * e^(i * -2.62) = 33.2933 + e^-2.0289
H_3 * U_3 = ((-3.26 * e^(i * pi) + 4.74) / (e^(i * 2 * pi) + 0.4 * e^(i * pi))) * -0.8 * e^(i * -1) = 10.6667 + e^2.1416

Részben helyes válasz.

A correct answer is 12, which can be typed in as follows: `12`

A correct answer is 1.05714285714, which can be typed in as follows: `1.05714285714`

A correct answer is $\frac{4.74-3.26\cdot\left(\frac{1}{2}+\frac{\sqrt{3}}{2}\right)}{\frac{\sqrt{3}\,j}{2}+0.4\cdot\left(\frac{1}{2}+\frac{\sqrt{3}}{2}\right)+0.5}$, which can be typed in as follows: `(4.74-3.26*(%i/2+sqrt(3)/2))/((sqrt(3)*%i)/2+0.4*(%i/2+sqrt(3)/2)+0.5)`

A correct answer is $\frac{4.74-3.26\cdot\left(\frac{\sqrt{3}\,j}{2}+\frac{1}{2}\right)}{0.4\cdot\left(\frac{\sqrt{3}\,j}{2}+\frac{1}{2}\right)+\frac{\sqrt{3}\,j}{2}-0.5}$, which can be typed in as follows: `(4.74-3.26*((sqrt(3)*%i)/2+1/2))/(0.4*((sqrt(3)*%i)/2+1/2)+(sqrt(3)*%i)/2-0.5)`

A correct answer is 13.3333333333, which can be typed in as follows: `13.3333333333`

A correct answer is 2.43142857142, which can be typed in as follows: `2.43142857142`

A correct answer is $\frac{9.4\cdot\sqrt{(4.74-1.63\cdot\sqrt{3})^2+2.6569}}{\sqrt{\left(\frac{\sqrt{3}}{2}+0.2\right)^2+(0.2\cdot\sqrt{3}+0.5)^2}}$, which can be typed in as follows: `(9.4*sqrt((4.74-1.63*sqrt(3))^2+2.6569))/sqrt((sqrt(3)/2+0.2)^2+(0.2*sqrt(3)+0.5)^2)`

A correct answer is 1, which can be typed in as follows: `1`

A correct answer is -0.32, which can be typed in as follows: `-0.32`

A correct answer is 33.2932851857, which can be typed in as follows: `33.2932851857`

A correct answer is 2, which can be typed in as follows: `2`

A correct answer is 1.11, which can be typed in as follows: `1.11`

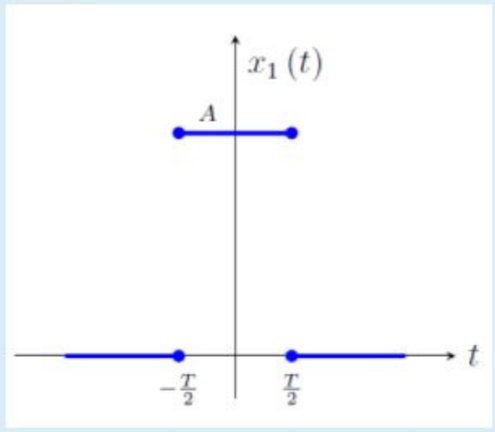
A correct answer is 10.6666666666, which can be typed in as follows: `10.6666666666`

A correct answer is 6, which can be typed in as follows: `6`

A correct answer is -1.0, which can be typed in as follows: `-1.0`

10.feladat

1. Adja meg az alábbi ábrán látható $x_1(t)$ szimmetrikus négyszögimpulzus komplex spektrumának C_1, C_2, C_3 és φ paramétereit, ha az impulzus amplitúdója A=6.4, a szélessége pedig T=10.1.



A spektrum alakja:

$$X_1(j\omega) = C_1 \frac{sin(\omega C_2)}{\omega C_3} e^{-j\varphi}$$

C1 = T * A = 6.4 * 10.1 = 64.64
C2 = C3 = T / 2 = 10.1 / 2 = 5.05

2. Adja meg a spektrum valós $(Re\{X_1(j\omega)\})$ és képzetes $(Im\{X_1(j\omega)\})$ részének értékét az ω=34 körfrekvencián.

Re { X_1(j * 34) } = 64.64 * sin(5.05 * 34 rad) / (5.05 * 34) = 0.3334
Im { X_1(j * 34) } = 0

3. Adja meg az $x_1(t)$ jel energiáját (E_1).

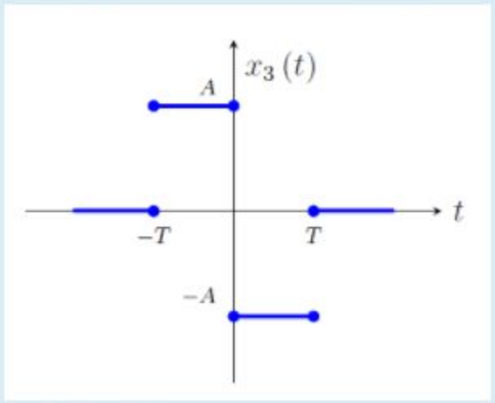
1 / (2 * pi) * integral from -inf to inf |64.64 * sin(5.05 * x) / (5.05 * x)|^2 = 413.696

Helyes válasz.

A correct answer is 64.64, which can be typed in as follows: `64.64`
A correct answer is 5.05, which can be typed in as follows: `5.05`
A correct answer is 5.05, which can be typed in as follows: `5.05`
A correct answer is 0, which can be typed in as follows: `0`
A correct answer is 0.333369417138, which can be typed in as follows: `0.333369417138`
A correct answer is 0, which can be typed in as follows: `0`
A correct answer is 413.696, which can be typed in as follows: `413.696`

11. feladat

1. Adja meg az alábbi ábrán látható $x_3(t)$ jel komplex spektrumának C_1, C_2, C_3 és C_4 paramétereit, ha az impulzus amplitúdója A=6.4, a T=10.1.



A spektrum alakja:

$$X_3(j\omega) = C_1 \frac{sin^2(\omega C_2)}{\omega C_3} e^{jC_4}$$

C_1 = 2 * A * T = 2 * 6.4 * 10.1 = 129.28
C_2 = C_3 = I / 2 = 10.1 / 2 = 5.05
C_4 = pi / 2 = 1.57079632679

2. Adja meg a spektrum valós $(Re\{X_3(j\omega)\})$ és képzetes $(Im\{X_3(j\omega)\})$ részének C_5 - C_9 paramétereit, ha a függvények alakjai a következőek:

$$Re\{X_3(j\omega)\} = C_5$$

$$Im\{X_3(j\omega)\} = C_6 \frac{sin^2(\omega C_7)}{\omega C_8} e^{jC_9}$$

C_5 = 0
C_6 = C_1 = 129.28
C_7 = C_8 = C_2 = 5.05
C_9 = 0

3. Adja meg a spektrum valós $(Re\{X_3(j\omega)\})$ és képzetes $(Im\{X_3(j\omega)\})$ részének értékét az ω=34 körfrekvencián.

Re { X_3(j * 34) } = C_5 = 0
Im { X_3(j * 34) } = C_6 * sin^2(34 * C_7) / C_8 * e^(j * C_9) = im(129.28 * sin^2(34 * 5.05 rad) / (34 * 5.05) * e^(i * 1.57079632679)) = 0.590406

4. Adja meg az $x_3(t)$ jel energiáját (E_3).

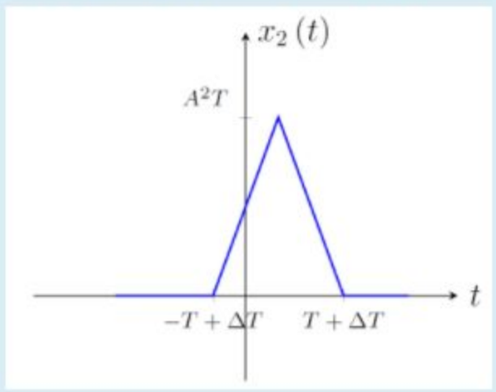
1 / (2 * pi) * integral from -inf to inf |129.28 * sin^2(x * 5.05) / (x * 5.05)|^2 = 827.392

Helyes válasz.

A correct answer is 129.28, which can be typed in as follows: `129.28`
A correct answer is 5.05, which can be typed in as follows: `5.05`
A correct answer is 5.05, which can be typed in as follows: `5.05`
A correct answer is $\frac{\pi}{2}$, which can be typed in as follows: `%pi/2`
A correct answer is 0, which can be typed in as follows: `0`
A correct answer is 129.28, which can be typed in as follows: `129.28`
A correct answer is 5.05, which can be typed in as follows: `5.05`
A correct answer is 5.05, which can be typed in as follows: `5.05`
A correct answer is 0, which can be typed in as follows: `0`
A correct answer is 0, which can be typed in as follows: `0`
A correct answer is 0.590405581505, which can be typed in as follows: `0.590405581505`
A correct answer is 827.392, which can be typed in as follows: `827.392`

12. feladat

1. Adja meg az alábbi ábrán látható $x_2(t)$ jel komplex spektrumának C_1, C_2, C_3 és C_4 paramétereit, ha A=8.8, T=0.8 és ΔT = 1.



A spektrum alakja:

$$X_2(j\omega) = C_1 \frac{sin^2(\omega C_2)}{(\omega C_3)^2} e^{-j\omega C_4}$$

2. Adja meg a spektrum valós $(Re\{X_2(j\omega)\})$ és képzetes $(Im\{X_2(j\omega)\})$ részének C_5 - C_{14} paramétereit, ha a függvények alakjai a következõek:

$$Re\{X_2(j\omega)\} = C_5 \frac{sin^2(\omega C_6)}{(\omega C_7)^2} cos(\omega C_8) e^{-j\omega C_9}$$

$$Im\{X_2(j\omega)\} = -C_{10} \frac{sin^2(\omega C_{11})}{(\omega C_{12})^2} sin(\omega C_{13}) e^{-j\omega C_{14}}$$

Magic:

C_1 = C_5 = C_{10} = A^2*T^2 = 8.8^2 * 0.8^2 = 49.5616
C_2 = C_3 = C_6 = C_7 = C_{11} = C_{12} = T/2 = 0.8 / 2 = 0.4
C_4 = C_8 = C_{13} = ΔT = 1
C_9 = C_{14} = 0

3. Adja meg a spektrum valós $(Re\{X_2(j\omega)\})$ és képzetes $(Im\{X_2(j\omega)\})$ részének értékét az ω=9 körfrekvencián.

Re{X_2(j*9)} = C_5*(sin^2(9*C_6))/(9*C_7)^2*cos(9*C_8)*e^(-j*9*C_9) = 49.5616 * (sin^2(9 * 0.4 rad)) / (9 * 0.4)^2 * cos(9) * e^(0) = -0.6823
Im{X_2(j*9)} = -C_{10}*(sin^2(9*C_{11}))/(9*C_{12})^2*sin(9*C_{13})*e^(-j*9*C_{14}) = -49.5616 * (sin^2(9 * 0.4 rad)) / (9 * 0.4)^2 * sin(9) * e^(0) = -0.3086

4. Adja meg az $x_2(t)$ jel energiáját (E_2).

1 / (2 * pi) * integral from -inf to inf |49.5616 * (sin(0.4 * x)/(0.4 * x))^2 * e^(-i)|^2 = 2046.96

Helyes válasz.

A correct answer is 49.5616, which can be typed in as follows: `49.5616`
A correct answer is 0.4, which can be typed in as follows: `0.4`
A correct answer is 0.4, which can be typed in as follows: `0.4`
A correct answer is 1, which can be typed in as follows: `1`
A correct answer is 49.5616, which can be typed in as follows: `49.5616`
A correct answer is 0.4, which can be typed in as follows: `0.4`
A correct answer is 0.4, which can be typed in as follows: `0.4`
A correct answer is 1, which can be typed in as follows: `1`
A correct answer is 0, which can be typed in as follows: `0`
A correct answer is 49.5616, which can be typed in as follows: `49.5616`
A correct answer is 0.4, which can be typed in as follows: `0.4`
A correct answer is 0.4, which can be typed in as follows: `0.4`
A correct answer is 1, which can be typed in as follows: `1`
A correct answer is 0, which can be typed in as follows: `0`
A correct answer is $0.748870967965 \cdot \cos(9)$, which can be typed in as follows: `0.748870967965*cos(9)`
A correct answer is $-0.748870967965 \cdot \sin(9)$, which can be typed in as follows: `-0.748870967965*sin(9)`
A correct answer is 2046.96016213, which can be typed in as follows: `2046.96016213`