2nd order process transfer function

$$G_P(s) = \frac{K_P}{\tau^2 \cdot s^2 + 2\zeta\cdot\tau\cdot s + 1}$$

$\tau \equiv 2$ NB: global assignment in a MathCad worksheet

$\zeta := 2$

$$G_P(s) := \frac{1}{\tau^2 \cdot s^2 + 2\zeta\cdot\tau\cdot s + 1}$$

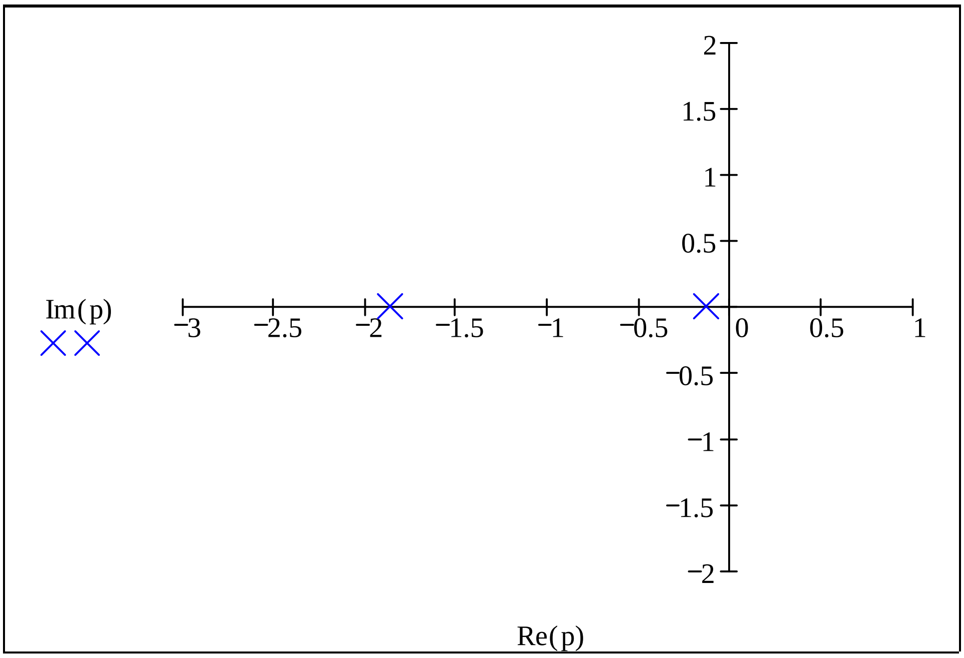
Characteristic polynomial coefficients, a(ζ), written as a vector:

$$a := \begin{pmatrix} 1 \\ 2\cdot\zeta\cdot\tau \\ \tau^2 \end{pmatrix}$$

NB: observe that the last element of a(ζ) is the coefficient of s^2.

$p := \text{polyroots}(a)$

$$p = \begin{pmatrix} -1.000\dfrac{226974.000}{262087.000} \\ -\dfrac{75658.000}{564719.000} \end{pmatrix}$$



La anti-trasf. di Laplace a impulso è: $y(t) := G_P(s) \text{ invlaplace}, s \rightarrow \frac{1}{6}\cdot\exp(-t)\cdot 3^{\frac{1}{2}}\cdot\sinh\left(\frac{1}{2}\cdot 3^{\frac{1}{2}}\cdot t\right)$

$\zeta := 1.5$

$$G_P(s) := \frac{1}{\tau^2 \cdot s^2 + 2\zeta \cdot \tau \cdot s + 1}$$

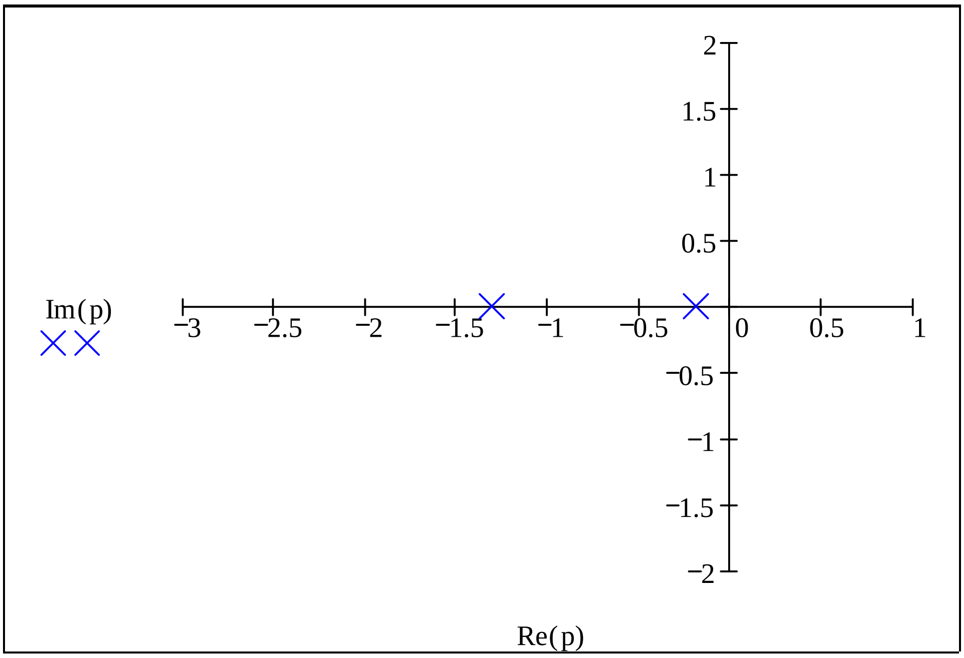
Characteristic polynomial coefficients, a(ζ), written as a vector:

$$a := \begin{pmatrix} 1 \\ 2\cdot\zeta\cdot\tau \\ \tau^2 \end{pmatrix}$$

...observe that the last element of a(ζ) is the coefficient of s^n.

$p := \text{polyroots}(a)$

$$p = \begin{pmatrix} -1.000\,\frac{98209.000}{317811.000} \\ -\frac{98209.000}{514229.000} \end{pmatrix}$$



$$\zeta := 1.1$$

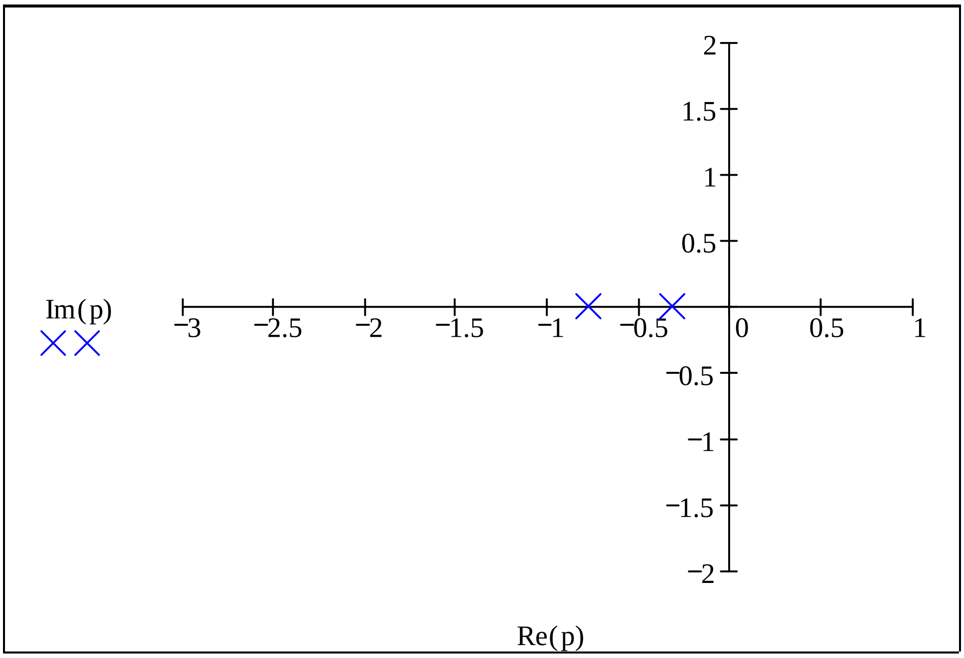
Characteristic polynomial coefficients, a(ζ), written as a vector:

$$a := \begin{pmatrix} 1 \\ 2\cdot\zeta\cdot\tau \\ \tau^2 \end{pmatrix}$$

...observe that the last element of a(ζ) is the coefficient of s^n.

$$p := \text{polyroots}(a)$$

$$p = \begin{pmatrix} -\dfrac{725940.000}{931733.000} \\ -\dfrac{205793.000}{641357.000} \end{pmatrix}$$



$\zeta := 1.005$

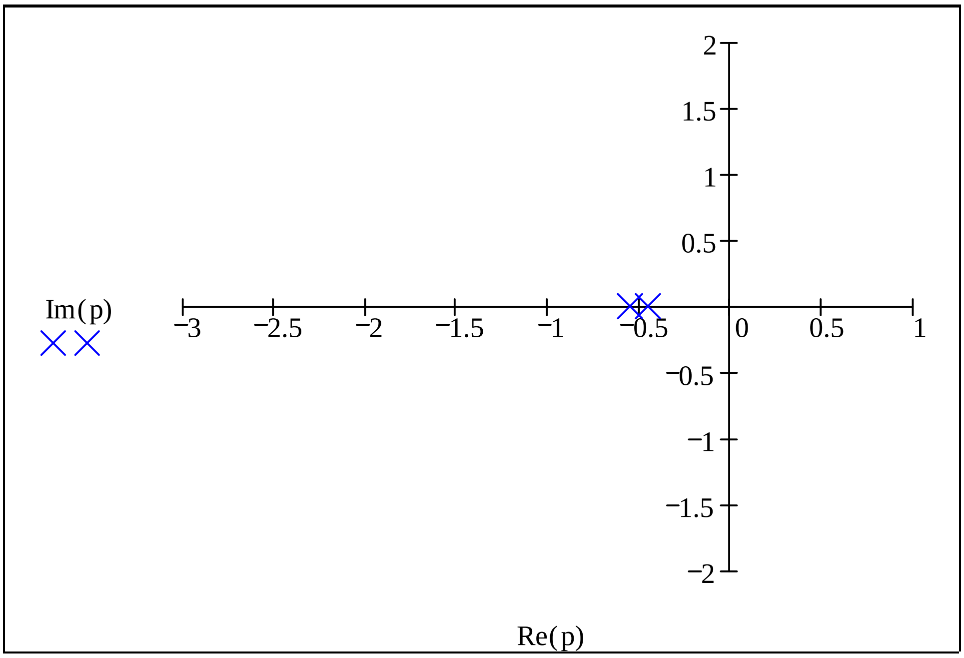
Characteristic polynomial coefficients, a(ζ), written as a vector:

$$a := \begin{pmatrix} 1 \\ 2\cdot\zeta\cdot\tau \\ \tau^2 \end{pmatrix}$$

...observe that the last element of a(ζ) is the coefficient of s^n.

$p := \text{polyroots}(a)$

$$p = \begin{pmatrix} -\dfrac{328405.000}{594331.000} \\ -\dfrac{281936.000}{623149.000} \end{pmatrix}$$



$\zeta := 1$

$$G_P(s) := \frac{1}{\tau^2 \cdot s^2 + 2\zeta \cdot \tau \cdot s + 1}$$

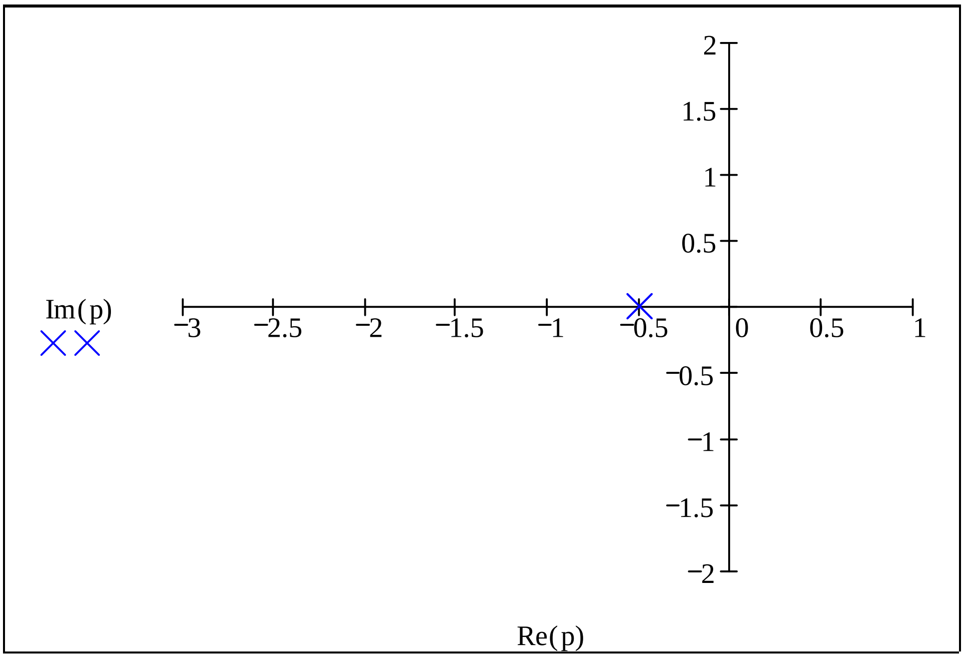
Characteristic polynomial coefficients, a(ζ), written as a vector:

$$a := \begin{pmatrix} 1 \\ 2\cdot\zeta\cdot\tau \\ \tau^2 \end{pmatrix}$$

...observe that the last element of a(ζ) is the coefficient of s^n.

$p := \text{polyroots}(a)$

$$p = \begin{pmatrix} -\frac{1.000}{2.000} \\ -\frac{1.000}{2.000} \end{pmatrix}$$



La anti-trasf. di Laplace a impulso è:

$$y(t) := G_P(s) \text{ invlaplace}, s \rightarrow \frac{1}{4}\cdot t\cdot \exp\left(\frac{-1}{2}\cdot t\right)$$

$\zeta := 0.99$

$$G_P(s) := \frac{1}{\tau^2 \cdot s^2 + 2\zeta \cdot \tau \cdot s + 1}$$

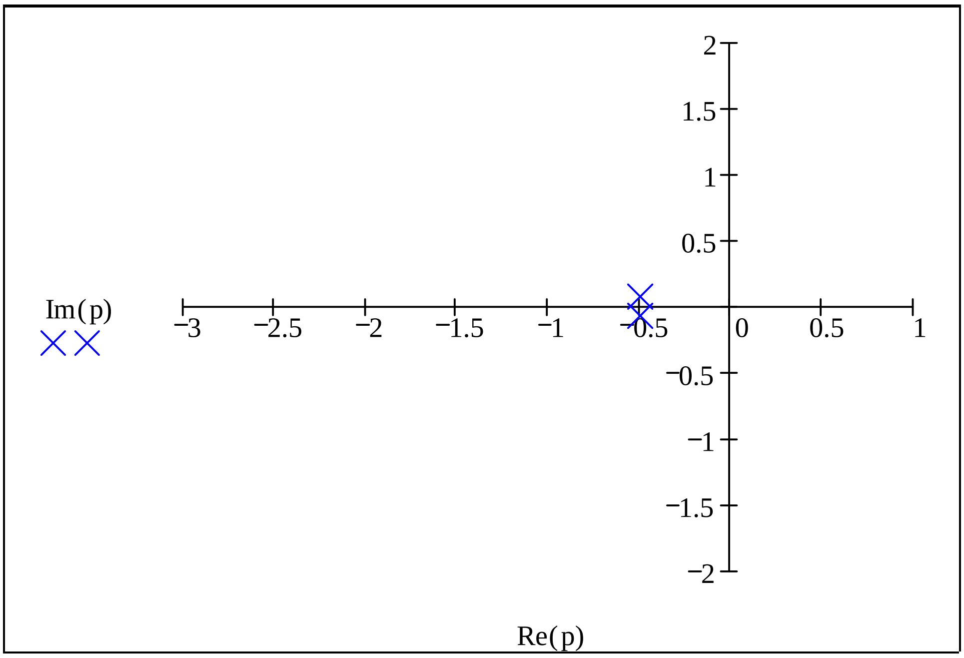
Characteristic polynomial coefficients, a(ζ), written as a vector:

$$a := \begin{pmatrix} 1 \\ 2 \cdot \zeta \cdot \tau \\ \tau^2 \end{pmatrix}$$

...observe that the last element of a(ζ) is the coefficient of s^n.

$p := \text{polyroots}(a)$

$$p = \begin{pmatrix} -0.495 - 0.071j \\ -0.495 + 0.071j \end{pmatrix}$$



$y(t) := G_P(s) \text{ invlaplace}, s \rightarrow$

$\zeta := 0.9$

$$G_P(s) := \frac{1}{\tau^2 \cdot s^2 + 2\zeta \cdot \tau \cdot s + 1}$$

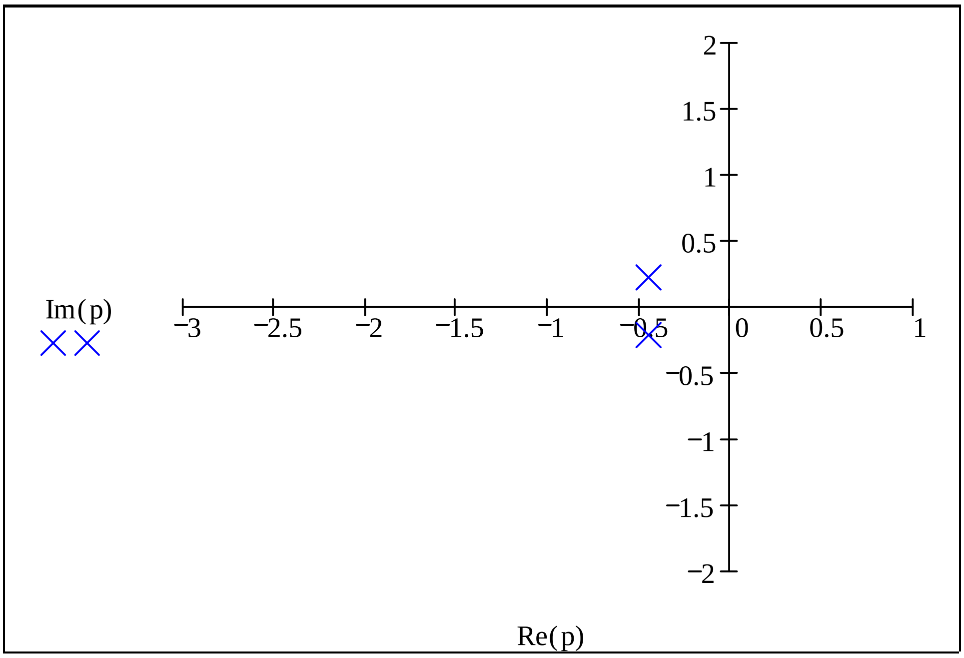
Characteristic polynomial coefficients, a(ζ), written as a vector:

$$a := \begin{pmatrix} 1 \\ 2 \cdot \zeta \cdot \tau \\ \tau^2 \end{pmatrix}$$

...observe that the last element of a(ζ) is the coefficient of s^n.

$p := \text{polyroots}(a)$

$$p = \begin{pmatrix} -0.450 + 0.218j \\ -0.450 - 0.218j \end{pmatrix}$$



$y(t) := G_P(s) \text{ invlaplace}, s \rightarrow$ ▮

$\zeta := 0.5$

$$G_P(s) := \frac{1}{\tau^2 \cdot s^2 + 2\zeta\cdot\tau\cdot s + 1}$$

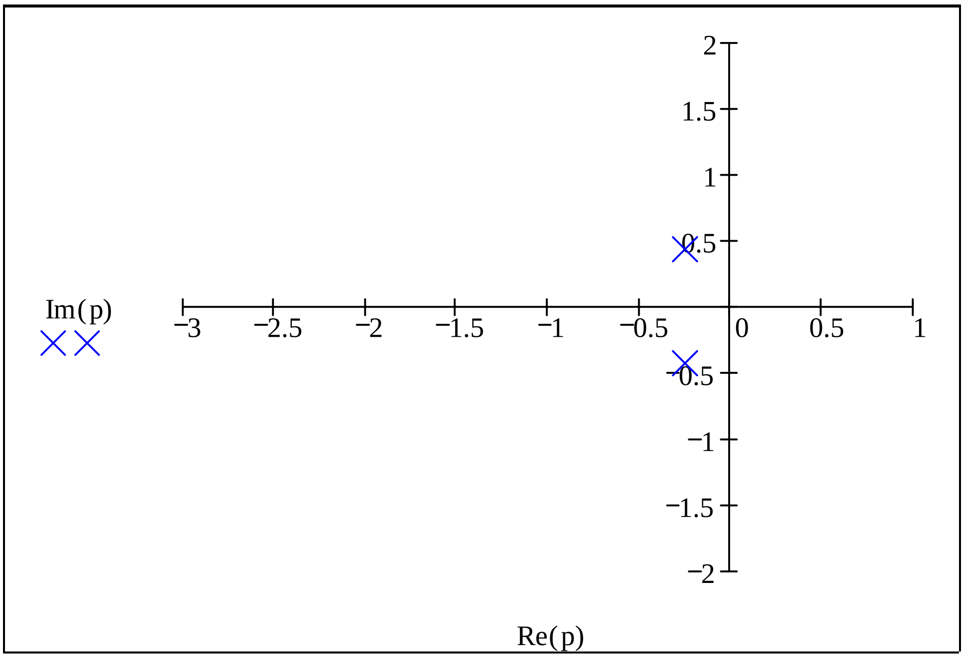
Characteristic polynomial coefficients, a(ζ), written as a vector:

$$a := \begin{pmatrix} 1 \\ 2\cdot\zeta\cdot\tau \\ \tau^2 \end{pmatrix}$$

...observe that the last element of a(ζ) is the coefficient of s^n.

$p := \text{polyroots}(a)$

$$p = \begin{pmatrix} -0.250 - 0.433j \\ -0.250 + 0.433j \end{pmatrix}$$



$y(t) := G_P(s)$ invlaplace, s $\rightarrow$

$\zeta := 0.2$

$$G_P(s) := \frac{1}{\tau^2 \cdot s^2 + 2\zeta \cdot \tau \cdot s + 1}$$

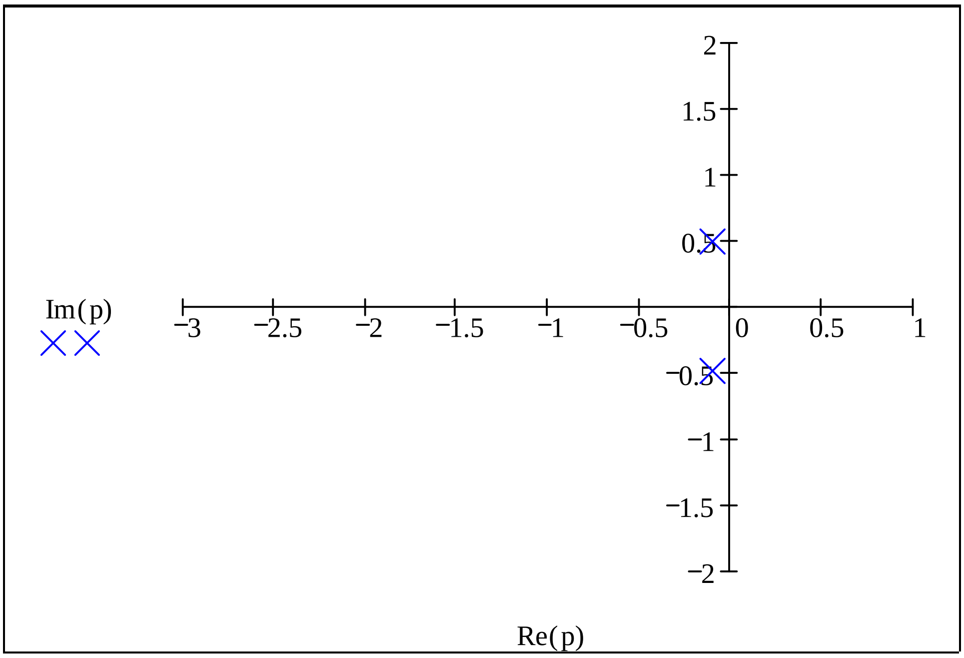
Characteristic polynomial coefficients, a(ζ), written as a vector:

$$a := \begin{pmatrix} 1 \\ 2 \cdot \zeta \cdot \tau \\ \tau^2 \end{pmatrix}$$

...observe that the last element of a(ζ) is the coefficient of s^n.

$p := \text{polyroots}(a)$

$$p = \begin{pmatrix} -0.100 + 0.490j \\ -0.100 - 0.490j \end{pmatrix}$$



$y(t) := G_P(s)$ invlaplace, s →

$\zeta := 0.1$

$$G_P(s) := \frac{1}{\tau^2 \cdot s^2 + 2\zeta \cdot \tau \cdot s + 1}$$

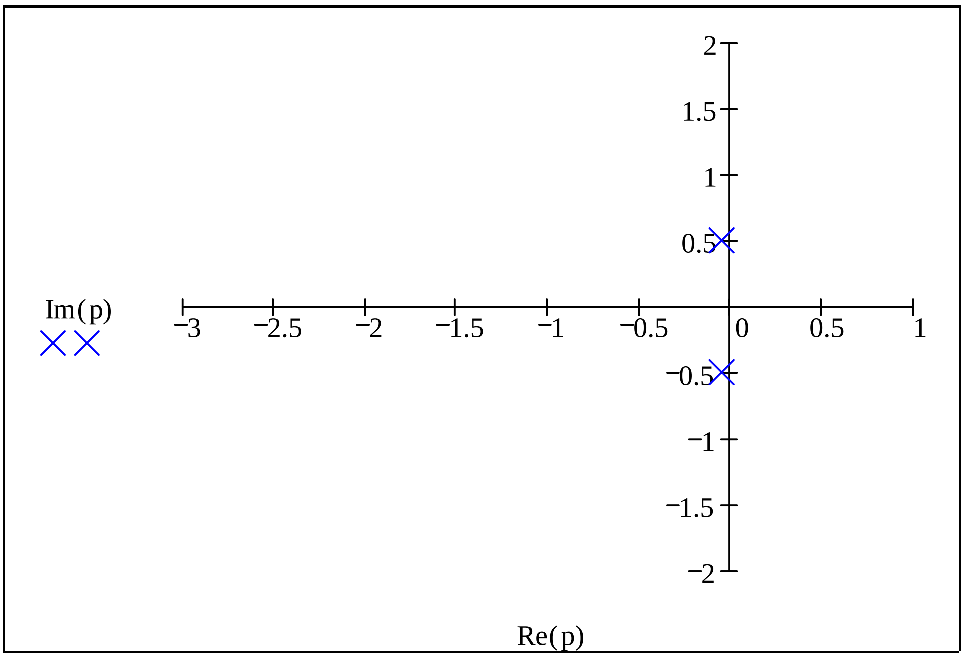
Characteristic polynomial coefficients, a(ζ), written as a vector:

$$a := \begin{pmatrix} 1 \\ 2 \cdot \zeta \cdot \tau \\ \tau^2 \end{pmatrix}$$

...observe that the last element of a(ζ) is the coefficient of s^n.

$p := \text{polyroots}(a)$

$$p = \begin{pmatrix} -0.050 - 0.497j \\ -0.050 + 0.497j \end{pmatrix}$$



$y(t) := G_P(s) \text{ invlaplace}, s \rightarrow$

$\zeta := 0$

$$G_P(s) := \frac{1}{\tau^2 \cdot s^2 + 2\zeta \cdot \tau \cdot s + 1}$$

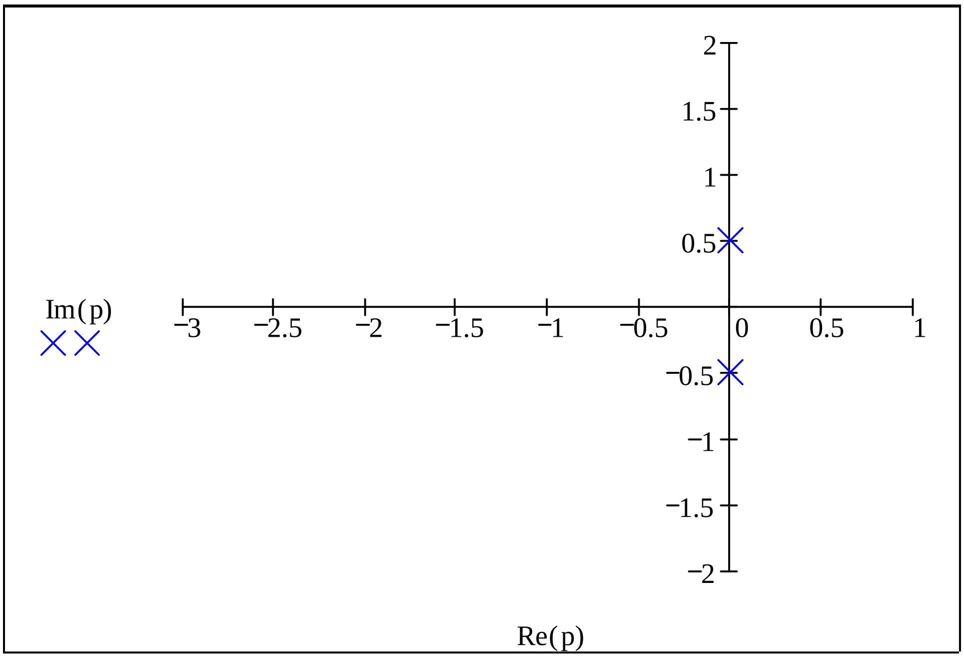
Characteristic polynomial coefficients, a(ζ), written as a vector:

$$a := \begin{pmatrix} 1 \\ 2 \cdot \zeta \cdot \tau \\ \tau^2 \end{pmatrix}$$

...observe that the last element of a(ζ) is the coefficient of s^n.

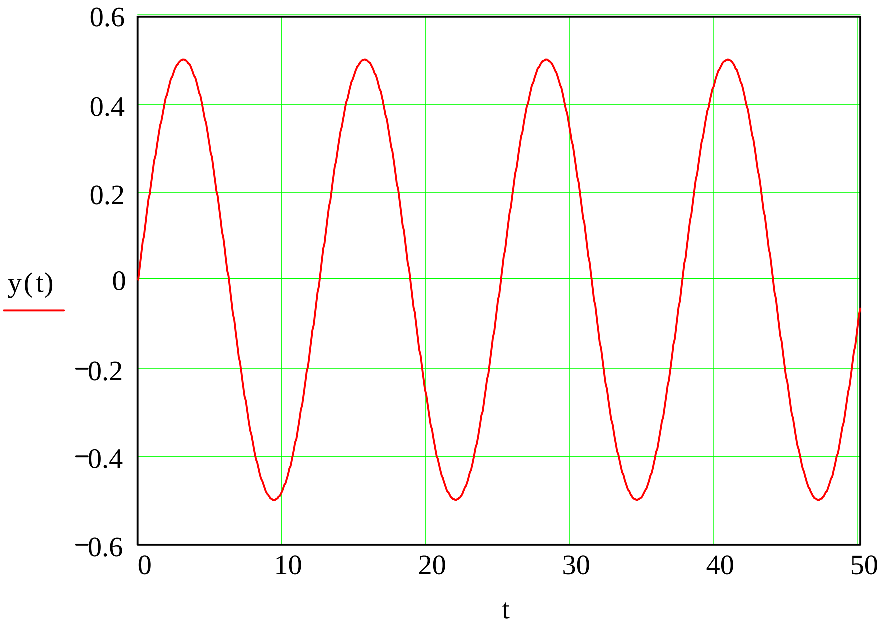
$p := \text{polyroots}(a)$

$$p = \begin{pmatrix} -0.500j \\ 0.500j \end{pmatrix}$$



La anti-trasf. di Laplace a impulso è:

$$y(t) := G_P(s) \text{ invlaplace}, s \rightarrow \frac{1}{2} \cdot \sin\left(\frac{1}{2} \cdot t\right)$$



$\zeta := -0.1$

$G_P(s) := \dfrac{1}{\tau^2 \cdot s^2 + 2\zeta \cdot \tau \cdot s + 1}$

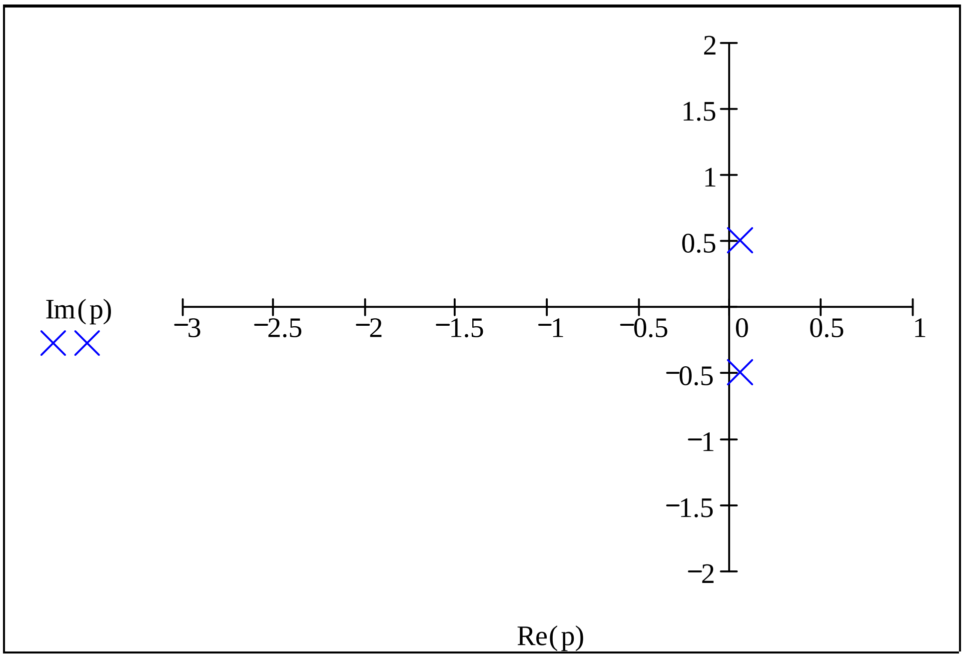
Characteristic polynomial coefficients, a(ζ), written as a vector:

$a := \begin{pmatrix} 1 \\ 2 \cdot \zeta \cdot \tau \\ \tau^2 \end{pmatrix}$

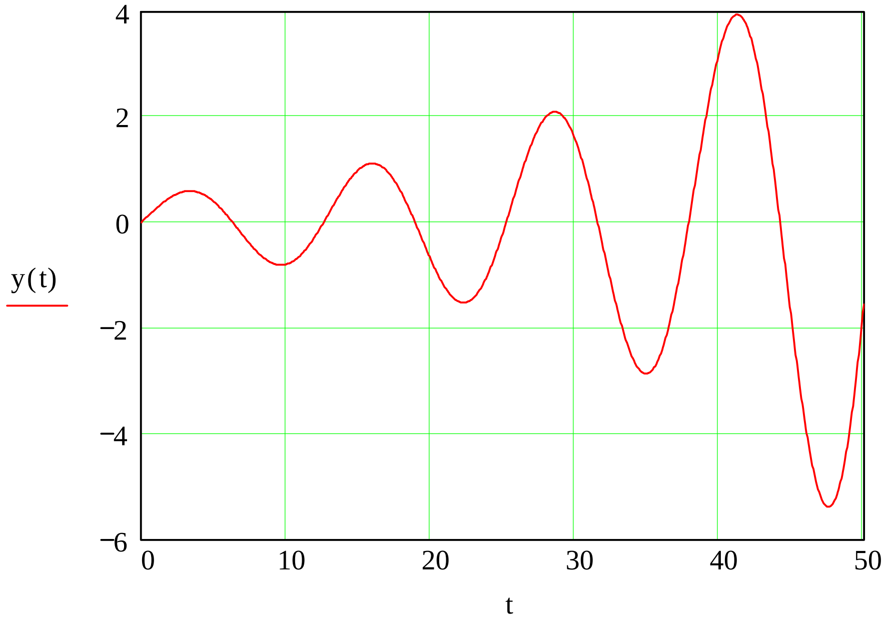
NB: observe that the last element of a(ζ) is the coefficient of s^2.

$p := \text{polyroots}(a)$

$p = \begin{pmatrix} 0.050 - 0.497j \\ 0.050 + 0.497j \end{pmatrix}$



$$y(t) := G_P(s) \text{ invlaplace}, s \rightarrow .50251890762960603774 \cdot \exp\left(5.0000000000000000000 \cdot 10^{-2}\right.$$



$^{2} \cdot t) \cdot \sin(.49749371855330997737 \cdot t)$