

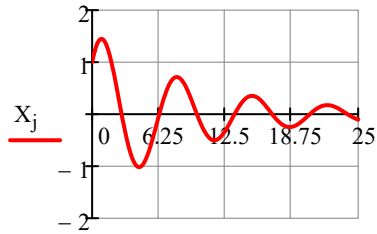
$$A := \begin{pmatrix} 1 & -1 \\ 2 & -1.2 \end{pmatrix} \quad \lambda := \text{eigenvals}(A) = \begin{pmatrix} -0.1 + 0.889i \\ -0.1 - 0.889i \end{pmatrix}$$

$$D(t, x) := A \cdot x \quad T := 25 \quad N := 300$$

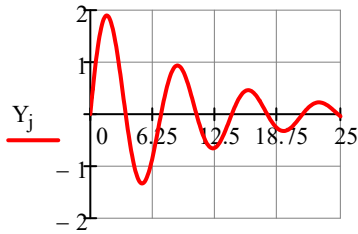
$$x(x_0, y_0) := \text{rkfixed} \left[\begin{pmatrix} x_0 \\ y_0 \end{pmatrix}, 0, T, N, D \right] \quad i := 0..N \quad \text{FRAME} := N \blacksquare$$

$$t := x(1, 0)^{\langle 0 \rangle} \quad X := x(1, 0)^{\langle 1 \rangle} \quad Y := x(1, 0)^{\langle 2 \rangle}$$

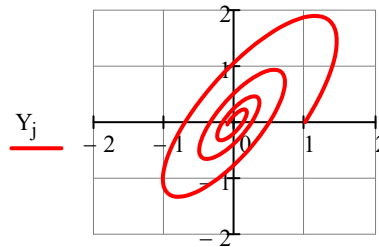
$$j := 0..N$$



t_j



t_j



X_j

$$\begin{pmatrix} x_1 \\ y_1 \end{pmatrix} := \begin{pmatrix} 1 \\ 0 \end{pmatrix} \quad \begin{pmatrix} v_{1x} \\ v_{1y} \end{pmatrix} := A \cdot \begin{pmatrix} x_1 \\ y_1 \end{pmatrix} \quad \begin{pmatrix} x_2 \\ y_2 \end{pmatrix} := \begin{pmatrix} 0 \\ -0.75 \end{pmatrix} \quad \begin{pmatrix} v_{2x} \\ v_{2y} \end{pmatrix} := A \cdot \begin{pmatrix} x_2 \\ y_2 \end{pmatrix} \quad \begin{pmatrix} x_5 \\ y_5 \end{pmatrix} := \begin{pmatrix} -0.47577 \\ 0.40685 \end{pmatrix}$$

$$\begin{pmatrix} x_3 \\ y_3 \end{pmatrix} := \begin{pmatrix} -0.91832 \\ -1.2964 \end{pmatrix} \quad \begin{pmatrix} v_{3x} \\ v_{3y} \end{pmatrix} := A \cdot \begin{pmatrix} x_3 \\ y_3 \end{pmatrix} \quad \begin{pmatrix} x_4 \\ y_4 \end{pmatrix} := \begin{pmatrix} 1.1812 \\ 1.8951 \end{pmatrix} \quad \begin{pmatrix} v_{4x} \\ v_{4y} \end{pmatrix} := A \cdot \begin{pmatrix} x_4 \\ y_4 \end{pmatrix} \quad \begin{pmatrix} v_{5x} \\ v_{5y} \end{pmatrix} := A \cdot \begin{pmatrix} x_5 \\ y_5 \end{pmatrix}$$

$$s := 0.3$$

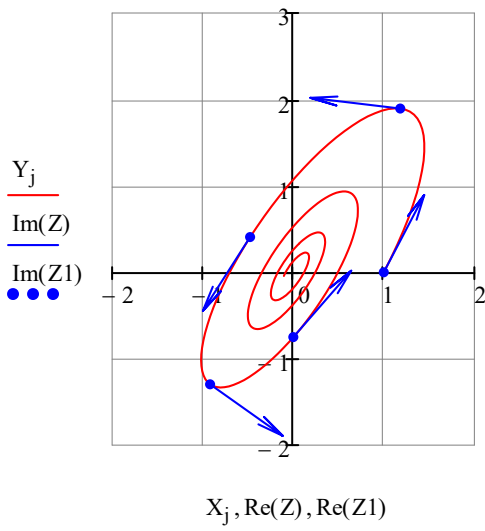
$$Z1 := \sqrt{\frac{v_{1x} + i \cdot v_{1y}}{|v_{1x} + i \cdot v_{1y}|}} \cdot s + x_1 + i \cdot y_1 \quad Z2 := \sqrt{\frac{v_{2x} + i \cdot v_{2y}}{|v_{2x} + i \cdot v_{2y}|}} \cdot s + x_2 + i \cdot y_2$$

$$Z3 := \sqrt{\frac{v_{3x} + i \cdot v_{3y}}{|v_{3x} + i \cdot v_{3y}|}} \cdot s + x_3 + i \cdot y_3 \quad Z4 := \sqrt{\frac{v_{4x} + i \cdot v_{4y}}{|v_{4x} + i \cdot v_{4y}|}} \cdot s + x_4 + i \cdot y_4$$

$$Z5 := \sqrt{\frac{v_{5x} + i \cdot v_{5y}}{|v_{5x} + i \cdot v_{5y}|}} \cdot s + x_5 + i \cdot y_5$$

$$\sigma := 10^3 \quad Z := \text{stack}(Z1, \sigma, Z2, \sigma, Z3, \sigma, Z4, \sigma, Z5) \quad Z1 := (x_1 + i \cdot y_1 \quad x_2 + i \cdot y_2 \quad x_3 + i \cdot y_3 \quad x_4 + i \cdot y_4 \quad x_5 + i \cdot y_5)^T$$

$$V(z, s) := \begin{bmatrix} 0 \\ z \\ z + s \cdot e^{i \cdot (\arg(z) + 170 \cdot \text{deg})} \\ z \\ z + s \cdot e^{i \cdot (\arg(z) - 170 \cdot \text{deg})} \end{bmatrix}$$



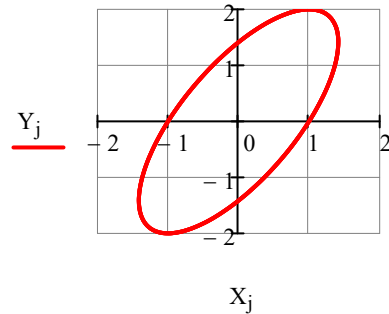
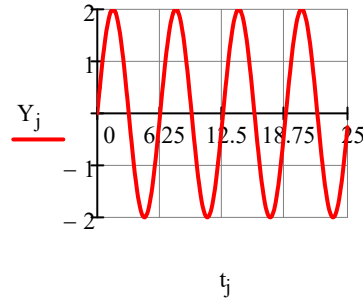
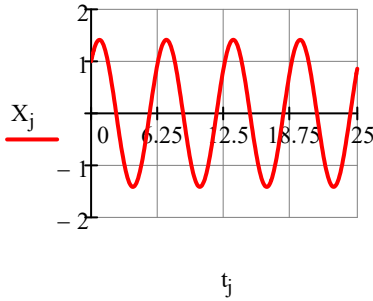
$$A := \begin{pmatrix} 1 & -1 \\ 2 & -1 \end{pmatrix} \quad \lambda := \text{eigenvals}(A) = \begin{pmatrix} i \\ -i \end{pmatrix}$$

$$\underline{\underline{D}}(t, x) := A \cdot x \quad \underline{\underline{T}} := 25 \quad \underline{\underline{N}} := 300$$

$$\underline{\underline{x}}(x_0, y_0) := \text{rkfixed} \left[\begin{pmatrix} x_0 \\ y_0 \end{pmatrix}, 0, T, N, D \right] \quad i := 0..N \quad \text{FRAME} := N$$

$$t := x(1,0)^{\langle 0 \rangle} \quad X := x(1,0)^{\langle 1 \rangle} \quad Y := x(1,0)^{\langle 2 \rangle}$$

$$j := 0..N$$



$$\begin{pmatrix} \underline{\underline{x1}} \\ \underline{\underline{y1}} \end{pmatrix} := \begin{pmatrix} 1 \\ 0 \end{pmatrix} \quad \begin{pmatrix} \underline{\underline{v1x}} \\ \underline{\underline{v1y}} \end{pmatrix} := A \cdot \begin{pmatrix} x1 \\ y1 \end{pmatrix} \quad \begin{pmatrix} \underline{\underline{x2}} \\ \underline{\underline{y2}} \end{pmatrix} := \begin{pmatrix} -1 \\ 0 \end{pmatrix} \quad \begin{pmatrix} \underline{\underline{v2x}} \\ \underline{\underline{v2y}} \end{pmatrix} := A \cdot \begin{pmatrix} x2 \\ y2 \end{pmatrix}$$

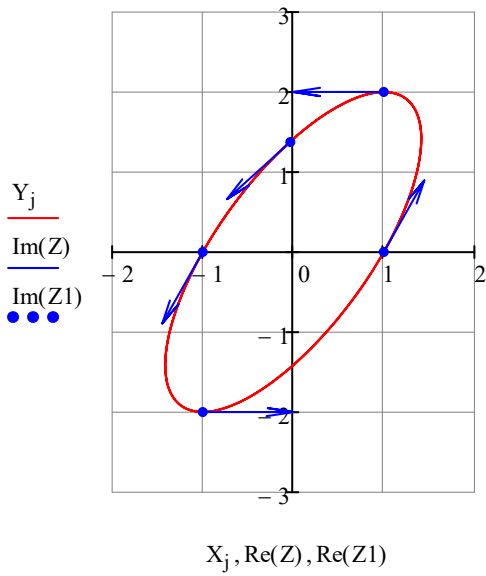
$$\begin{pmatrix} \underline{\underline{x3}} \\ \underline{\underline{y3}} \end{pmatrix} := \begin{pmatrix} 1 \\ 2 \end{pmatrix} \quad \begin{pmatrix} \underline{\underline{v3x}} \\ \underline{\underline{v3y}} \end{pmatrix} := A \cdot \begin{pmatrix} x3 \\ y3 \end{pmatrix} \quad \begin{pmatrix} \underline{\underline{x4}} \\ \underline{\underline{y4}} \end{pmatrix} := \begin{pmatrix} -1 \\ -2 \end{pmatrix} \quad \begin{pmatrix} \underline{\underline{v4x}} \\ \underline{\underline{v4y}} \end{pmatrix} := A \cdot \begin{pmatrix} x4 \\ y4 \end{pmatrix} \quad \begin{pmatrix} \underline{\underline{x5}} \\ \underline{\underline{y5}} \end{pmatrix} := \begin{pmatrix} -0.033149 \\ 1.375 \end{pmatrix}$$

$$\underline{\underline{\sigma}} := 0.3 \quad Z1 := V \left(\frac{v1_x + i \cdot v1_y}{|v1_x + i \cdot v1_y|}, s \right) + x1 + i \cdot y1 \quad Z2 := V \left(\frac{v2_x + i \cdot v2_y}{|v2_x + i \cdot v2_y|}, s \right) + x2 + i \cdot y2 \quad \begin{pmatrix} \underline{\underline{v5x}} \\ \underline{\underline{v5y}} \end{pmatrix} := A \cdot \begin{pmatrix} x5 \\ y5 \end{pmatrix}$$

$$\underline{\underline{Z3}} := V \left(\frac{v3_x + i \cdot v3_y}{|v3_x + i \cdot v3_y|}, s \right) + x3 + i \cdot y3 \quad \underline{\underline{Z4}} := V \left(\frac{v4_x + i \cdot v4_y}{|v4_x + i \cdot v4_y|}, s \right) + x4 + i \cdot y4 \quad \underline{\underline{Z5}} := V \left(\frac{v5_x + i \cdot v5_y}{|v5_x + i \cdot v5_y|}, s \right) + x5 + i \cdot y5$$

$$\underline{\underline{\sigma}} := 10^3 \quad Z := \text{stack}(Z1, \sigma, Z2, \sigma, Z3, \sigma, Z4, \sigma, Z5)$$

$$\underline{\underline{Z1}} := (x1 + i \cdot y1 \quad x2 + i \cdot y2 \quad x3 + i \cdot y3 \quad x4 + i \cdot y4 \quad x5 + i \cdot y5)^T$$



Yo := Y Xo := X to := t

$$\begin{pmatrix} Vx_i \\ Vy_i \end{pmatrix} := D \begin{pmatrix} t_i \\ \begin{bmatrix} (Xo)_i \\ (Yo)_i \end{bmatrix} \end{pmatrix}$$

$$A1 := \begin{pmatrix} 1 & -1 \\ -3 & -1 \end{pmatrix} \quad \lambda := \text{eigenvals}(A) = \begin{pmatrix} i \\ -i \end{pmatrix} \quad I := \text{identity}(2) = \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$$

$$A1 - I \cdot \lambda_0 \text{ float}, 4 \rightarrow \begin{pmatrix} 1.0 - 1.0i & -1.0 \\ -3.0 & -1.0 - 1.0i \end{pmatrix} \quad A1 - I \cdot \lambda_1 \text{ float}, 4 \rightarrow \begin{pmatrix} 1.0 + 1.0i & -1.0 \\ -3.0 & -1.0 + 1.0i \end{pmatrix}$$

$$\underline{x1} := -1 \quad \underline{y1} := 1 \quad \underline{x2} := 1 \quad \underline{y2} := 3$$

$$\Lambda1 := \begin{pmatrix} 0 \\ x1 + iy1 \end{pmatrix} \cdot 3 \quad \Lambda2 := \begin{pmatrix} 0 \\ x2 + i \cdot y2 \end{pmatrix} \cdot 3$$

$$\underline{D}(t, x) := A1 \cdot x \quad \underline{T} := 2 \quad \underline{N} := 300$$

$$\underline{x}(x0, y0) := \text{rkfixed} \left[\begin{pmatrix} x0 \\ y0 \end{pmatrix}, 0, T, N, D \right] \quad i := 0..N \quad \text{FRAME} := N$$

$$\underline{x1} := 1.1538 \quad \underline{y1} := 2.5$$

$$t := x(x1, y1)^{\langle 0 \rangle} \quad X := x(x1, y1)^{\langle 1 \rangle} \quad Y := x(x1, y1)^{\langle 2 \rangle}$$

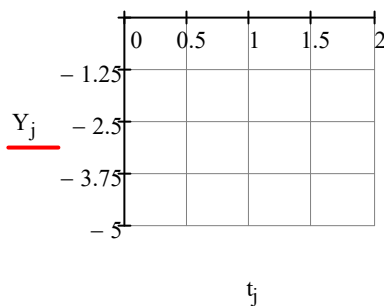
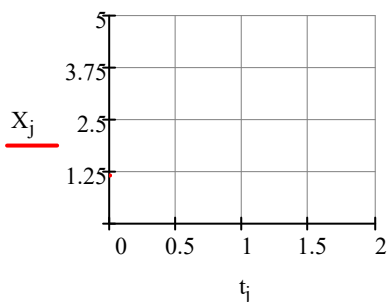
$$X1 := x(-x1, -y1)^{\langle 1 \rangle} \quad \underline{Y1} := x(-x1, -y1)^{\langle 2 \rangle}$$

$$\underline{x2} := 0.58052 \quad \underline{y2} := 2.5$$

$$X2 := x(x2, y2)^{\langle 1 \rangle} \quad Y2 := x(x2, y2)^{\langle 2 \rangle}$$

$$X_2 := x(-x2, -y2)^{\langle 1 \rangle} \quad Y_2 := x(-x2, -y2)^{\langle 2 \rangle}$$

j := 0..FRAME



X_ := stack(X, σ, X1, σ, X2, σ, X_2)

$$\begin{pmatrix} \underline{x1} \\ \underline{y1} \end{pmatrix} := \begin{pmatrix} -2.5 \\ 2.5 \end{pmatrix} \quad \begin{pmatrix} \underline{v1} \\ \underline{y1} \end{pmatrix} := A1 \cdot \begin{pmatrix} x1 \\ y1 \end{pmatrix} \quad \begin{pmatrix} \underline{x2} \\ \underline{y2} \end{pmatrix} := \begin{pmatrix} 2.5 \\ -2.5 \end{pmatrix} \quad \begin{pmatrix} \underline{v2} \\ \underline{y2} \end{pmatrix} := A1 \cdot \begin{pmatrix} x2 \\ y2 \end{pmatrix}$$

Y_ := stack(Y, σ, Y1, σ, Y2, σ, Y_2)
 S := stack(Λ1, 0, -Λ1, 0, Λ2, 0, -Λ2)

$$Z1(v1_x, v1_y, x1, y1) := V \left(\frac{v1_x + i \cdot v1_y}{|v1_x + i \cdot v1_y|}, s \right) + x1 + i \cdot y1$$

z1 := Z1(v1_x, v1_y, x1, y1)

$$\begin{pmatrix} x3 \\ y3 \end{pmatrix} := \begin{pmatrix} 0.85 \\ 2.5 \end{pmatrix} \quad \begin{pmatrix} v3_x \\ v3_y \end{pmatrix} := A1 \cdot \begin{pmatrix} x3 \\ y3 \end{pmatrix} \quad \begin{pmatrix} x4 \\ y4 \end{pmatrix} := \begin{pmatrix} -0.85 \\ -2.5 \end{pmatrix} \quad \begin{pmatrix} v4_x \\ v4_y \end{pmatrix} := A1 \cdot \begin{pmatrix} x4 \\ y4 \end{pmatrix}$$

z2 := Z1(v2_x, v2_y, x2, y2)

$$\begin{pmatrix} x55 \\ y55 \end{pmatrix} := \begin{pmatrix} -0.35 \\ 1.33 \end{pmatrix} \quad \begin{pmatrix} v5_x \\ v5_y \end{pmatrix} := A1 \cdot \begin{pmatrix} x55 \\ y55 \end{pmatrix}$$

$$\begin{pmatrix} x66 \\ y66 \end{pmatrix} := \begin{pmatrix} 0.35 \\ -1.33 \end{pmatrix} \quad \begin{pmatrix} v6_x \\ v6_y \end{pmatrix} := A1 \cdot \begin{pmatrix} x66 \\ y66 \end{pmatrix}$$

z3 := Z1(v3_x, v3_y, x3, y3)

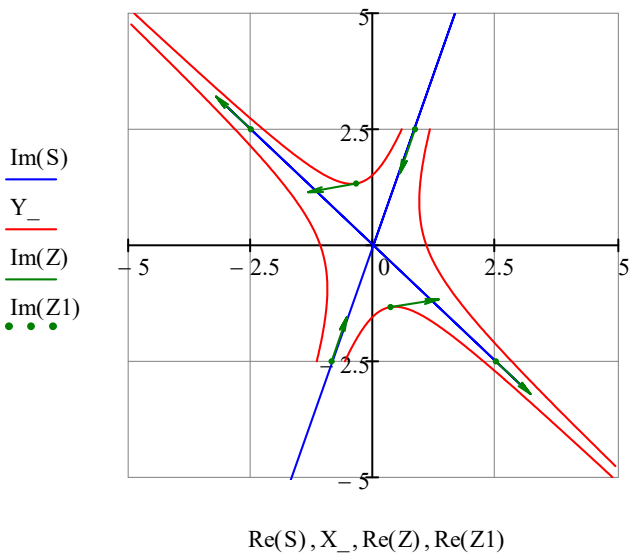
z4 := Z1(v4_x, v4_y, x4, y4)

z5 := Z1(v5_x, v5_y, x55, y55)

z6 := Z1(v6_x, v6_y, x66, y66)

Z := stack(z1, σ, z2, σ, z3, σ, z4, σ, z5, σ, z6)

$$Z1 := (x1 + i \cdot y1 \quad x2 + i \cdot y2 \quad x3 + i \cdot y3 \quad x4 + i \cdot y4 \quad x55 + i \cdot y55 \quad x66 + i \cdot y66)^T$$



$$Z1 = \begin{pmatrix} -2.5 + 2.5i \\ 2.5 - 2.5i \\ 0.85 + 2.5i \\ -0.85 - 2.5i \\ -0.35 + 1.33i \\ 0.35 - 1.33i \end{pmatrix}$$

FRAME := 200

k := FRAME

j := 0..k

$$Z := \text{if} \left(k = 0, 0, V \left(\frac{Vx_k + i \cdot Vy_k}{|Vx_k + i \cdot Vy_k| \cdot 2}, s \right) \right) + Xo_k + zo := Xo_k + i \cdot Yo_k$$

