

```
> with(LinearAlgebra) :
> K := Matrix(2, 2, [4, -2, -2, 2])
```

$$K := \begin{bmatrix} 4 & -2 \\ -2 & 2 \end{bmatrix} \quad (1)$$

```
> M := Matrix(2, 2, [4, 1, 1, 2])
```

$$M := \begin{bmatrix} 4 & 1 \\ 1 & 2 \end{bmatrix} \quad (2)$$

```
> v, e := evalf(Eigenvalues(K, M))
```

$$v, e := \begin{bmatrix} 2.640754482 \\ 0.216388376 \end{bmatrix}, \begin{bmatrix} -0.7071067812 & 0.7071067820 \\ 1. & 1. \end{bmatrix} \quad (3)$$

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> Frequência do 1o. modo de vibrar
```

```
> f[1] := evalf( (sqrt(v[2]) / (2*Pi)) )
```

$$f_1 := 0.07403500249 \quad (4)$$

```
> Frequência do 2o. modo de vibrar
```

```
> f[2] := evalf( (sqrt(v[1]) / (2*Pi)) )
```

$$f_2 := 0.2586331232 \quad (5)$$

```
> N := Matrix(2, 2, [4*(1 - omega^2), -2 - omega^2, -2 - omega^2, 2*(1 - omega^2)])
```

$$N := \begin{bmatrix} 4 - 4\omega^2 & -2 - \omega^2 \\ -2 - \omega^2 & 2 - 2\omega^2 \end{bmatrix} \quad (6)$$

```
> subs(omega = sqrt(v[1]), N)
```

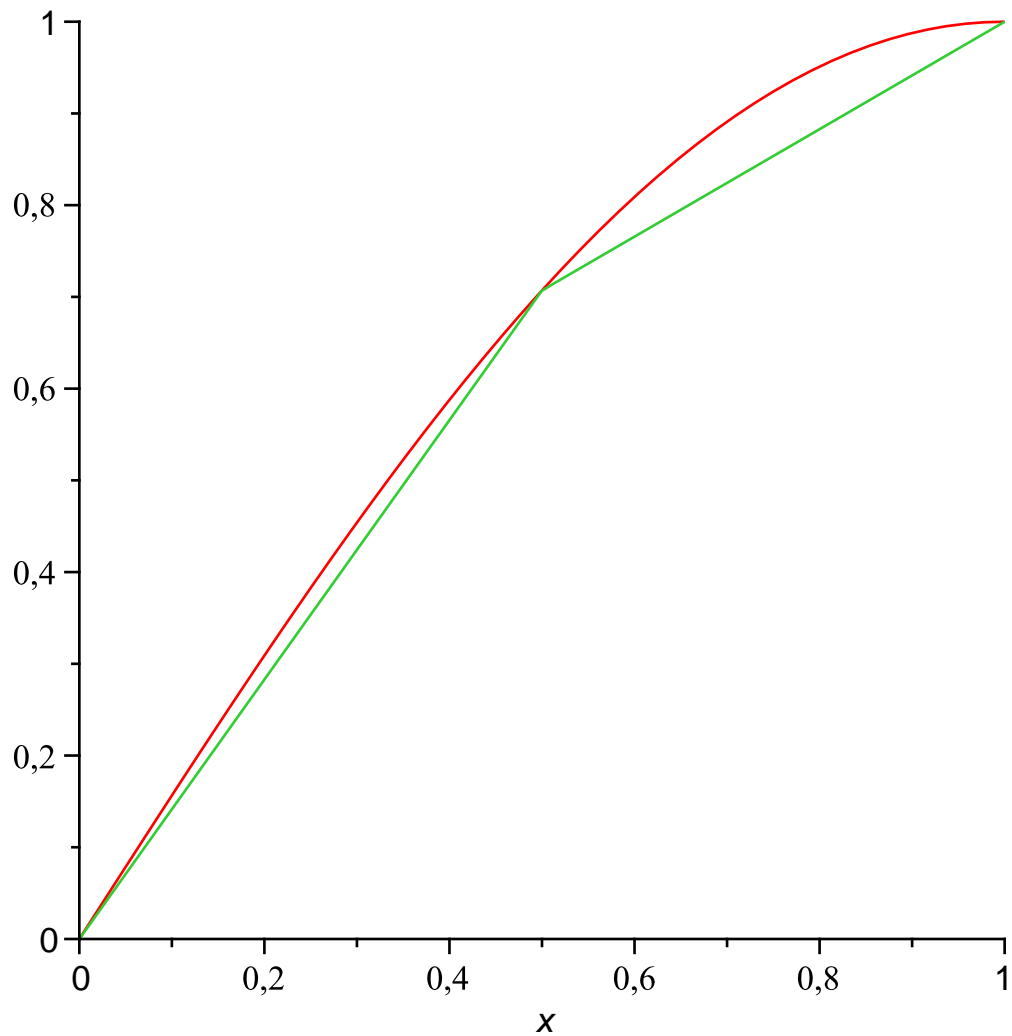
$$\begin{bmatrix} -6.56301793 & -4.640754482 \\ -4.640754482 & -3.281508964 \end{bmatrix} \quad (7)$$

```
> phi[1] := xi -> piecewise( xi >= 0 and xi <= 1, 1 - xi, 0) :
```

```
> phi[2] := xi -> piecewise( xi >= 0 and xi <= 1, xi, 0) :
```

```
> 1o. modo de vibrar
```

```
> plot( [ subs(omega = Pi/2, sin(omega*x)), phi[1](2*x)*0 + (phi[2](2*x) + phi[1](2*(x - 1/2))) ) . e[1, 2] + phi[2](2*(x - 1/2)) . e[2, 2], x=0..1 )
```



> 2o. modo de vibrar

>  $plot\left(\left[subs\left(\omega = \frac{3 \cdot \text{Pi}}{2}, \sin(\omega \cdot x)\right), \text{phi}[1](2 \cdot x) \cdot 0 - \left(\text{phi}[2](2 \cdot x) + \text{phi}[1]\left(2 \cdot \left(x - \frac{1}{2}\right)\right)\right) \cdot e[1, 1] - \text{phi}[2]\left(2 \cdot \left(x - \frac{1}{2}\right)\right) \cdot e[2, 1]\right], x=0..1\right)$

