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> restart
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Problema del arco recurvo y la flecha de MADERA
Fase dinámica FLECHA 1
> gravedad :=  $\frac{981}{100}$ ; Hooke :=  $\frac{14}{\left(\frac{4}{10}\right)}$ ; Peso :=  $\frac{16}{1000}$ 
      gravedad :=  $\frac{981}{100}$ 
      Hooke := 35
      Peso :=  $\frac{2}{125}$  (1)
> Ecuacion := diff(s(t), t$2) *  $\left(\frac{Peso}{gravedad}\right) = -Hooke \cdot s(t)$ 
      Ecuacion :=  $\frac{8 \frac{d^2}{dt^2} s(t)}{4905} = -35 s(t)$  (2)
> CondIni := s(0) =  $-\frac{39}{100}$ , D(s)(0) = 0
      CondIni := s(0) =  $-\frac{39}{100}$ , D(s)(0) = 0 (3)
> SolucionParticular := dsolve({Ecuacion, CondIni}); evalf(%, 4)
      SolucionParticular := s(t) =  $-\frac{39 \cos\left(\frac{15 \sqrt{1526} t}{4}\right)}{100}$ 
      s(t) =  $-0.3900 \cos(146.5 t)$  (4)
> tiempo := solve(rhs(SolucionParticular) = 0, t); evalf(%, 3)
      tiempo :=  $\frac{\pi \sqrt{1526}}{11445}$ 
      0.0108 (5)
> Velocidad := subs(t = tiempo, rhs(diff(SolucionParticular, t))); evalf(%, 3)
      Velocidad :=  $\frac{117 \sqrt{1526} \sin\left(\frac{\pi}{2}\right)}{80}$ 
      57.1 (6)
>
Problema cinemático
> Velocidad

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$$\frac{117 \sqrt{1526}}{80} \quad (7)$$

> EcuacionVertical := diff(y(t), t\$2) = -gravedad

$$EcuacionVertical := \frac{d^2}{dt^2} y(t) = -\frac{981}{100} \quad (8)$$

> EcuacionHorizontal := diff(x(t), t) = Velocidad \* cos(Pi/4)

$$EcuacionHorizontal := \frac{d}{dt} x(t) = \frac{117 \sqrt{1526} \sqrt{2}}{160} \quad (9)$$

> evalf(Pi, 100)

$$3.14159265358979323846264338327950288419716939937510582097494459230781640628620 \backslash 8998628034825342117068 \quad (10)$$

> CondVertical := y(0) = 2, D(y)(0) = Velocidad \* sin(Pi/4)

$$CondVertical := y(0) = 2, D(y)(0) = \frac{117 \sqrt{1526} \sqrt{2}}{160} \quad (11)$$

> CondHorizontal := x(0) = 0

$$CondHorizontal := x(0) = 0 \quad (12)$$

> SolucionVertical := dsolve({EcuacionVertical, CondVertical}); evalf(%, 3)

$$SolucionVertical := y(t) = -\frac{981 t^2}{200} + \frac{117 \sqrt{763} t}{80} + 2$$

$$y(t) = -4.90 t^2 + 40.3 t + 2. \quad (13)$$

> SolucionHorizontal := dsolve({EcuacionHorizontal, CondHorizontal}); evalf(%, 3)

$$SolucionHorizontal := x(t) = \frac{117 \sqrt{763} t}{80}$$

$$x(t) = 40.3 t \quad (14)$$

> TiempoVuelo := solve(rhs(SolucionVertical) = 0, t); evalf(%, 3)

$$TiempoVuelo := \frac{65 \sqrt{763}}{436} - \frac{5 \sqrt{1188427}}{1308}, \frac{65 \sqrt{763}}{436} + \frac{5 \sqrt{1188427}}{1308}$$

$$-0.05, 8.27 \quad (15)$$

> DistanciaMax := subs(t = TiempoVuelo[2], rhs(SolucionHorizontal)); evalf(%, 3)

$$DistanciaMax := \frac{117 \sqrt{763} \left( \frac{65 \sqrt{763}}{436} + \frac{5 \sqrt{1188427}}{1308} \right)}{80}$$

$$333. \quad (16)$$

> TiempoAltura := solve(rhs(diff(SolucionVertical, t)) = 0, t); evalf(%, 3)

$$TiempoAltura := \frac{65 \sqrt{763}}{436}$$

4.11

(17)

>  $AlturaMax := \text{subs}(t = \text{TiempoAltura}, \text{rhs}(\text{SolucionVertical})); \text{evalf}(\%, 3)$

$$AlturaMax := \frac{10903}{128}$$

85.2

(18)

> restart

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> restart

Problema del arco recurvo y la flecha de MADERA

Fase dinámica FLECHA 2

>  $gravedad := \frac{981}{100}; Hooke := \frac{14}{\left(\frac{4}{10}\right)}; Peso := \frac{16}{1000}$

$$gravedad := \frac{981}{100}$$

$$Hooke := 35$$

$$Peso := \frac{2}{125}$$

(19)

>  $Ecuacion := \text{diff}(s(t), t\$2) \cdot \left(\frac{Peso}{gravedad}\right) = -Hooke \cdot s(t)$

$$Ecuacion := \frac{8 \frac{d^2}{dt^2} s(t)}{4905} = -35 s(t)$$

(20)

>  $CondIni := s(0) = -\frac{39}{100}, D(s)(0) = 0$

$$CondIni := s(0) = -\frac{39}{100}, D(s)(0) = 0$$

(21)

>  $SolucionParticular := \text{dsolve}(\{Ecuacion, CondIni\}); \text{evalf}(\%, 4)$

$$SolucionParticular := s(t) = -\frac{39 \cos\left(\frac{15 \sqrt{1526} t}{4}\right)}{100}$$

$$s(t) = -0.3900 \cos(146.5 t)$$

(22)

>  $tiempo := \text{solve}(\text{rhs}(\text{SolucionParticular}) = 0, t); \text{evalf}(\%, 3)$

$$tiempo := \frac{\pi \sqrt{1526}}{11445}$$

0.0108

(23)

>  $Velocidad := \text{subs}(t = tiempo, \text{rhs}(\text{diff}(\text{SolucionParticular}, t))); \text{evalf}(\%, 3)$

$$Velocidad := \frac{117 \sqrt{1526} \sin\left(\frac{\pi}{2}\right)}{80}$$

Problema cinemático

> Velocidad

$$\frac{117 \sqrt{1526}}{80} \quad (25)$$

> EcuacionVertical := diff(y(t), t\$2) = -gravedad

$$EcuacionVertical := \frac{d^2}{dt^2} y(t) = -\frac{981}{100} \quad (26)$$

> EcuacionHorizontal := diff(x(t), t) = Velocidad · cos $\left(\frac{\text{Pi}}{4}\right)$

$$EcuacionHorizontal := \frac{d}{dt} x(t) = \frac{117 \sqrt{1526} \sqrt{2}}{160} \quad (27)$$

> evalf(Pi, 100)

$$3.14159265358979323846264338327950288419716939937510582097494459230781640628620 \backslash 8998628034825342117068 \quad (28)$$

> CondVertical := y(0) = 2, D(y)(0) = Velocidad · sin $\left(\frac{\text{Pi}}{4}\right)$

$$CondVertical := y(0) = 2, D(y)(0) = \frac{117 \sqrt{1526} \sqrt{2}}{160} \quad (29)$$

> CondHorizontal := x(0) = 0

$$CondHorizontal := x(0) = 0 \quad (30)$$

> SolucionVertical := dsolve({EcuacionVertical, CondVertical}); evalf(%, 3)

$$SolucionVertical := y(t) = -\frac{981}{200} t^2 + \frac{117 \sqrt{763}}{80} t + 2$$

$$y(t) = -4.90 t^2 + 40.3 t + 2. \quad (31)$$

> SolucionHorizontal := dsolve({EcuacionHorizontal, CondHorizontal}); evalf(%, 3)

$$SolucionHorizontal := x(t) = \frac{117 \sqrt{763}}{80} t$$

$$x(t) = 40.3 t \quad (32)$$

> TiempoVuelo := solve(rhs(SolucionVertical) = 0, t); evalf(%, 3)

$$TiempoVuelo := \frac{65 \sqrt{763}}{436} - \frac{5 \sqrt{1188427}}{1308}, \frac{65 \sqrt{763}}{436} + \frac{5 \sqrt{1188427}}{1308}$$

$$-0.05, 8.27 \quad (33)$$

> DistanciaMax := subs(t = TiempoVuelo[2], rhs(SolucionHorizontal)); evalf(%, 3)

$$DistanciaMax := \frac{117 \sqrt{763}}{80} \left( \frac{65 \sqrt{763}}{436} + \frac{5 \sqrt{1188427}}{1308} \right) \quad (34)$$

333. (34)

>  $TiempoAltura := solve(rhs(diff(SolucionVertical, t)) = 0, t); evalf(\%, 3)$

$$TiempoAltura := \frac{65\sqrt{763}}{436}$$

4.11 (35)

>  $AlturaMax := subs(t = TiempoAltura, rhs(SolucionVertical)); evalf(\%, 3)$

$$AlturaMax := \frac{10903}{128}$$

85.2 (36)

> restart

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> restart

Problema del arco recurvo y la flecha de ALUMINIO

Fase dinámica FLECHA 3

>  $gravedad := \frac{981}{100}; Hooke := \frac{14}{\left(\frac{4}{10}\right)}; Peso := \frac{21}{1000}$

$$gravedad := \frac{981}{100}$$

$$Hooke := 35$$

$$Peso := \frac{21}{1000}$$

(37)

>  $Ecuacion := diff(s(t), t\$2) \cdot \left(\frac{Peso}{gravedad}\right) = -Hooke \cdot s(t)$

$$Ecuacion := \frac{7 \frac{d^2}{dt^2} s(t)}{3270} = -35 s(t)$$

(38)

>  $CondIni := s(0) = -\frac{44}{100}, D(s)(0) = 0$

$$CondIni := s(0) = -\frac{11}{25}, D(s)(0) = 0$$

(39)

>  $SolucionParticular := dsolve(\{Ecuacion, CondIni\}); evalf(\%, 4)$

$$SolucionParticular := s(t) = -\frac{11 \cos(5\sqrt{654} t)}{25}$$

$$s(t) = -0.4400 \cos(127.8 t)$$

(40)

>  $tiempo := solve(rhs(SolucionParticular) = 0, t); evalf(\%, 3)$

$$tiempo := \frac{\pi \sqrt{654}}{6540}$$

$$0.0123 \quad (41)$$

> *Velocidad* := subs(*t* = tiempo, rhs(diff(*SolucionParticular*, *t*))); evalf(%, 3)

$$Velocidad := \frac{11 \sqrt{654} \sin\left(\frac{\pi}{2}\right)}{5} = 56.3 \quad (42)$$

>  
Problema cinemático

> *Velocidad*

$$\frac{11 \sqrt{654}}{5} \quad (43)$$

> *EcuacionVertical* := diff(*y*(*t*), *t*\$2) = -*gravedad*

$$EcuacionVertical := \frac{d^2}{dt^2} y(t) = -\frac{981}{100} \quad (44)$$

> *EcuacionHorizontal* := diff(*x*(*t*), *t*) = *Velocidad* · cos( $\frac{\text{Pi}}{4}$ )

$$EcuacionHorizontal := \frac{d}{dt} x(t) = \frac{11 \sqrt{654} \sqrt{2}}{10} \quad (45)$$

> evalf(Pi, 100)

$$3.14159265358979323846264338327950288419716939937510582097494459230781640628620 \backslash 8998628034825342117068 \quad (46)$$

> *CondVertical* := *y*(0) = 2, D(*y*)(0) = *Velocidad* · sin( $\frac{\text{Pi}}{4}$ )

$$CondVertical := y(0) = 2, D(y)(0) = \frac{11 \sqrt{654} \sqrt{2}}{10} \quad (47)$$

> *CondHorizontal* := *x*(0) = 0

$$CondHorizontal := x(0) = 0 \quad (48)$$

> *SolucionVertical* := dsolve({*EcuacionVertical*, *CondVertical*}); evalf(%, 3)

$$SolucionVertical := y(t) = -\frac{981}{200} t^2 + \frac{11 \sqrt{327}}{5} t + 2$$

$$y(t) = -4.90 t^2 + 39.8 t + 2. \quad (49)$$

> *SolucionHorizontal* := dsolve({*EcuacionHorizontal*, *CondHorizontal*}); evalf(%, 3)

$$SolucionHorizontal := x(t) = \frac{11 \sqrt{327}}{5} t$$

$$x(t) = 39.8 t \quad (50)$$

> *TiempoVuelo* := solve(rhs(*SolucionVertical*) = 0, *t*); evalf(%, 3)

$$TiempoVuelo := \frac{220 \sqrt{327}}{981} - \frac{40 \sqrt{10137}}{981}, \frac{220 \sqrt{327}}{981} + \frac{40 \sqrt{10137}}{981}$$

$$-0.03, 8.13 \quad (51)$$

> DistanciaMax := subs(t = TiempoVuelo[2], rhs(SolucionHorizontal)); evalf(%, 3)

$$\text{DistanciaMax} := \frac{11 \sqrt{327} \left( \frac{220 \sqrt{327}}{981} + \frac{40 \sqrt{10137}}{981} \right)}{5}$$

323. (52)

> TiempoAltura := solve(rhs(diff(SolucionVertical, t)) = 0, t); evalf(%, 3)

$$\text{TiempoAltura} := \frac{220 \sqrt{327}}{981}$$

4.05 (53)

> AlturaMax := subs(t = TiempoAltura, rhs(SolucionVertical)); evalf(%, 3)

$$\text{AlturaMax} := \frac{248}{3}$$

82.7 (54)

>

> restart

Problema del arco recurvo y la flecha de ALUMINIO

Fase dinámica FLECHA 4

> gravedad :=  $\frac{981}{100}$ ; Hooke :=  $\frac{14}{\left(\frac{4}{10}\right)}$ ; Peso :=  $\frac{30}{1000}$

$$\text{gravedad} := \frac{981}{100}$$

$$\text{Hooke} := 35$$

$$\text{Peso} := \frac{3}{100}$$

(55)

> Ecuacion := diff(s(t), t\$2) \*  $\left(\frac{\text{Peso}}{\text{gravedad}}\right) = -\text{Hooke} \cdot s(t)$

$$\text{Ecuacion} := \frac{\frac{d^2}{dt^2} s(t)}{327} = -35 s(t)$$

(56)

> CondIni := s(0) =  $-\frac{44}{100}$ , D(s)(0) = 0

$$\text{CondIni} := s(0) = -\frac{11}{25}, D(s)(0) = 0$$

(57)

> SolucionParticular := dsolve({Ecuacion, CondIni}); evalf(%, 4)

$$\text{SolucionParticular} := s(t) = -\frac{11 \cos(\sqrt{11445} t)}{25}$$

$$s(t) = -0.4400 \cos(107.0 t)$$

(58)

> tiempo := solve(rhs(SolucionParticular) = 0, t); evalf(%, 3)

$$tiempo := \frac{\pi \sqrt{11445}}{22890}$$

$$0.0147 \quad (59)$$

> *Velocidad* := subs(*t* = tiempo, rhs(diff(*SolucionParticular*, *t*))); evalf(%, 3)

$$Velocidad := \frac{11 \sqrt{11445} \sin\left(\frac{\pi}{2}\right)}{25}$$

$$47.1 \quad (60)$$

>

Problema cinemático

> *Velocidad*

$$\frac{11 \sqrt{11445}}{25} \quad (61)$$

> *EcuacionVertical* := diff(*y*(*t*), *t*\$2) = -*gravedad*

$$EcuacionVertical := \frac{d^2}{dt^2} y(t) = -\frac{981}{100} \quad (62)$$

> *EcuacionHorizontal* := diff(*x*(*t*), *t*) = *Velocidad* · cos $\left(\frac{\text{Pi}}{4}\right)$

$$EcuacionHorizontal := \frac{d}{dt} x(t) = \frac{11 \sqrt{11445} \sqrt{2}}{50} \quad (63)$$

> evalf(Pi, 100)

$$3.14159265358979323846264338327950288419716939937510582097494459230781640628620 \backslash \quad (64)$$

$$8998628034825342117068$$

> *CondVertical* := *y*(0) = 2, D(*y*)(0) = *Velocidad* · sin $\left(\frac{\text{Pi}}{4}\right)$

$$CondVertical := y(0) = 2, D(y)(0) = \frac{11 \sqrt{11445} \sqrt{2}}{50} \quad (65)$$

> *CondHorizontal* := *x*(0) = 0

$$CondHorizontal := x(0) = 0 \quad (66)$$

> *SolucionVertical* := dsolve({*EcuacionVertical*, *CondVertical*}); evalf(%, 3)

$$SolucionVertical := y(t) = -\frac{981}{200} t^2 + \frac{11 \sqrt{22890}}{50} t + 2$$

$$y(t) = -4.90 t^2 + 33.2 t + 2. \quad (67)$$

> *SolucionHorizontal* := dsolve({*EcuacionHorizontal*, *CondHorizontal*}); evalf(%, 3)

$$SolucionHorizontal := x(t) = \frac{11 \sqrt{22890}}{50} t$$

$$x(t) = 33.2 t \quad (68)$$

> *TiempoVuelo* := solve(rhs(*SolucionVertical*) = 0, *t*); evalf(%, 3)



$$TiempoVuelo := \frac{22\sqrt{22890}}{981} - \frac{2\sqrt{2867790}}{981}, \frac{22\sqrt{22890}}{981} + \frac{2\sqrt{2867790}}{981} - 0.07, 6.83 \quad (69)$$

> DistanciaMax := subs(t=TiempoVuelo[2], rhs(SolucionHorizontal)); evalf(%, 3)

$$DistanciaMax := \frac{11\sqrt{22890} \left( \frac{22\sqrt{22890}}{981} + \frac{2\sqrt{2867790}}{981} \right)}{50} 227. \quad (70)$$

> TiempoAltura := solve(rhs(diff(SolucionVertical, t))=0, t); evalf(%, 3)

$$TiempoAltura := \frac{22\sqrt{22890}}{981} 3.38 \quad (71)$$

> AlturaMax := subs(t=TiempoAltura, rhs(SolucionVertical)); evalf(%, 3)

$$AlturaMax := \frac{877}{15} 58.5 \quad (72)$$

> restart

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> restart

Problema del arco recurvo y la flecha de ALUMINIO

Fase dinámica FLECHA 5

$$\begin{aligned} > gravedad := \frac{981}{100}; Hooke := \frac{14}{\left(\frac{4}{10}\right)}; Peso := \frac{29}{1000} \\ & gravedad := \frac{981}{100} \\ & Hooke := 35 \\ & Peso := \frac{29}{1000} \end{aligned} \quad (73)$$

> Ecuacion := diff(s(t), t\$2) \* \left( \frac{Peso}{gravedad} \right) = -Hooke \* s(t)

$$Ecuacion := \frac{29 \frac{d^2}{dt^2} s(t)}{9810} = -35 s(t) \quad (74)$$

> CondIni := s(0) = -\frac{48}{100}, D(s)(0) = 0

$$CondIni := s(0) = -\frac{12}{25}, D(s)(0) = 0 \quad (75)$$

> *SolucionParticular* := *dsolve*( {*Ecuacion*, *CondIni*}); *evalf*(%, 4)

$$SolucionParticular := s(t) = -\frac{12 \cos\left(\frac{15 \sqrt{44254} t}{29}\right)}{25}$$

$$s(t) = -0.4800 \cos(108.8 t) \quad (76)$$

> *tiempo* := *solve*(*rhs*(*SolucionParticular*) = 0, *t*); *evalf*(%, 3)

$$tiempo := \frac{\pi \sqrt{44254}}{45780}$$

$$0.0144 \quad (77)$$

> *Velocidad* := *subs*(*t* = *tiempo*, *rhs*(*diff*(*SolucionParticular*, *t*))); *evalf*(%, 3)

$$Velocidad := \frac{36 \sqrt{44254} \sin\left(\frac{\pi}{2}\right)}{145}$$

$$52.1 \quad (78)$$

>  
Problema cinemático

> *Velocidad*

$$\frac{36 \sqrt{44254}}{145} \quad (79)$$

> *EcuacionVertical* := *diff*(*y*(*t*), *t*\$2) = -*gravedad*

$$EcuacionVertical := \frac{d^2}{dt^2} y(t) = -\frac{981}{100} \quad (80)$$

> *EcuacionHorizontal* := *diff*(*x*(*t*), *t*) = *Velocidad* · *cos*( $\frac{\text{Pi}}{4}$ )

$$EcuacionHorizontal := \frac{d}{dt} x(t) = \frac{18 \sqrt{44254} \sqrt{2}}{145} \quad (81)$$

> *evalf*(*Pi*, 100)

$$3.14159265358979323846264338327950288419716939937510582097494459230781640628620 \backslash 8998628034825342117068 \quad (82)$$

> *CondVertical* := *y*(0) = 2, *D*(*y*)(0) = *Velocidad* · *sin*( $\frac{\text{Pi}}{4}$ )

$$CondVertical := y(0) = 2, D(y)(0) = \frac{18 \sqrt{44254} \sqrt{2}}{145} \quad (83)$$

> *CondHorizontal* := *x*(0) = 0

$$CondHorizontal := x(0) = 0 \quad (84)$$

> *SolucionVertical* := *dsolve*( {*EcuacionVertical*, *CondVertical*}); *evalf*(%, 3)

$$SolucionVertical := y(t) = -\frac{981 t^2}{200} + \frac{36 \sqrt{22127} t}{145} + 2$$

$$y(t) = -4.90 t^2 + 37.0 t + 2. \quad (85)$$

> *SolucionHorizontal* := *dsolve*( {*EcuacionHorizontal*, *CondHorizontal* } ); *evalf*(%, 3)

$$\text{SolucionHorizontal} := x(t) = \frac{36 \sqrt{22127} t}{145}$$

$$x(t) = 37.0 t$$

(86)

> *TiempoVuelo* := *solve*(*rhs*(*SolucionVertical*) = 0, *t*); *evalf*(%, 3)

$$\text{TiempoVuelo} := \frac{80 \sqrt{22127}}{3161} - \frac{20 \sqrt{3277957}}{9483}, \frac{80 \sqrt{22127}}{3161} + \frac{20 \sqrt{3277957}}{9483} \\ -0.05, 7.59$$

(87)

> *DistanciaMax* := *subs*(*t* = *TiempoVuelo*[2], *rhs*(*SolucionHorizontal*)); *evalf*(%, 3)

$$\text{DistanciaMax} := \frac{36 \sqrt{22127} \left( \frac{80 \sqrt{22127}}{3161} + \frac{20 \sqrt{3277957}}{9483} \right)}{145}$$

$$280.$$

(88)

> *TiempoAltura* := *solve*(*rhs*(*diff*(*SolucionVertical*, *t*)) = 0, *t*); *evalf*(%, 3)

$$\text{TiempoAltura} := \frac{80 \sqrt{22127}}{3161}$$

$$3.77$$

(89)

> *AlturaMax* := *subs*(*t* = *TiempoAltura*, *rhs*(*SolucionVertical*)); *evalf*(%, 3)

$$\text{AlturaMax} := \frac{2074}{29}$$

$$71.5$$

(90)

>

>

> *restart*

Problema del arco recurvo y la flecha de MADERA

Fase dinámica FLECHA 6

> *gravedad* :=  $\frac{981}{100}$ ; *Hooke* :=  $\frac{14}{\left(\frac{4}{10}\right)}$ ; *Peso* :=  $\frac{20}{1000}$

$$\text{gravedad} := \frac{981}{100}$$

$$\text{Hooke} := 35$$

$$\text{Peso} := \frac{1}{50}$$

(91)

> *Ecuacion* := *diff*(*s*(*t*), *t*\$2) ·  $\left( \frac{\text{Peso}}{\text{gravedad}} \right) = -\text{Hooke} \cdot \text{s}(t)$

$$\text{Ecuacion} := \frac{2 \frac{d^2}{dt^2} s(t)}{981} = -35 s(t)$$

(92)

$$\begin{aligned} > \text{CondIni} := s(0) = -\frac{49}{100}, D(s)(0) = 0 \\ &\text{CondIni} := s(0) = -\frac{49}{100}, D(s)(0) = 0 \end{aligned} \quad (93)$$

$$\begin{aligned} > \text{SolucionParticular} := \text{dsolve}(\{\text{Ecuacion}, \text{CondIni}\}); \text{evalf}(\%, 4) \\ &\text{SolucionParticular} := s(t) = -\frac{49 \cos\left(\frac{3\sqrt{7630} t}{2}\right)}{100} \\ &s(t) = -0.4900 \cos(131.0 t) \end{aligned} \quad (94)$$

$$\begin{aligned} > \text{tiempo} := \text{solve}(\text{rhs}(\text{SolucionParticular}) = 0, t); \text{evalf}(\%, 3) \\ &\text{tiempo} := \frac{\pi \sqrt{7630}}{22890} \\ &0.0120 \end{aligned} \quad (95)$$

$$\begin{aligned} > \text{Velocidad} := \text{subs}(t = \text{tiempo}, \text{rhs}(\text{diff}(\text{SolucionParticular}, t))); \text{evalf}(\%, 3) \\ &\text{Velocidad} := \frac{147 \sqrt{7630} \sin\left(\frac{\pi}{2}\right)}{200} \\ &64.2 \end{aligned} \quad (96)$$

>  
Problema cinemático

$$\begin{aligned} > \text{Velocidad} \\ &\frac{147 \sqrt{7630}}{200} \end{aligned} \quad (97)$$

$$\begin{aligned} > \text{EcuacionVertical} := \text{diff}(y(t), t^2) = -\text{gravedad} \\ &\text{EcuacionVertical} := \frac{d^2}{dt^2} y(t) = -\frac{981}{100} \end{aligned} \quad (98)$$

$$\begin{aligned} > \text{EcuacionHorizontal} := \text{diff}(x(t), t) = \text{Velocidad} \cdot \cos\left(\frac{\text{Pi}}{4}\right) \\ &\text{EcuacionHorizontal} := \frac{d}{dt} x(t) = \frac{147 \sqrt{7630} \sqrt{2}}{400} \end{aligned} \quad (99)$$

$$\begin{aligned} > \text{evalf}(\text{Pi}, 100) \\ &3.1415926535897932384626433832795028841971693993751058209749445923078164062862\backslash \end{aligned} \quad (100)$$

08998628034825342117068

$$\begin{aligned} > \text{CondVertical} := y(0) = 2, D(y)(0) = \text{Velocidad} \cdot \sin\left(\frac{\text{Pi}}{4}\right) \\ &\text{CondVertical} := y(0) = 2, D(y)(0) = \frac{147 \sqrt{7630} \sqrt{2}}{400} \end{aligned} \quad (101)$$

$$\begin{aligned} > \text{CondHorizontal} := x(0) = 0 \\ &\text{CondHorizontal} := x(0) = 0 \end{aligned} \quad (102)$$

> *SolucionVertical* := *dsolve*( {*EcuacionVertical*, *CondVertical*} ); *evalf*(%, 3)

$$\textit{SolucionVertical} := y(t) = -\frac{981}{200} t^2 + \frac{147\sqrt{3815}}{200} t + 2$$

$$y(t) = -4.90 t^2 + 45.4 t + 2.$$

(103)

> *SolucionHorizontal* := *dsolve*( {*EcuacionHorizontal*, *CondHorizontal*} ); *evalf*(%, 3)

$$\textit{SolucionHorizontal} := x(t) = \frac{147\sqrt{3815}}{200} t$$

$$x(t) = 45.4 t$$

(104)

> *TiempoVuelo* := *solve*(*rhs*(*SolucionVertical*) = 0, *t*); *evalf*(%, 3)

$$\textit{TiempoVuelo} := \frac{49\sqrt{3815}}{654} - \frac{\sqrt{1037135}}{218}, \frac{49\sqrt{3815}}{654} + \frac{\sqrt{1037135}}{218} \\ -0.05, 9.31$$

(105)

> *DistanciaMax* := *subs*(*t* = *TiempoVuelo*[2], *rhs*(*SolucionHorizontal*)); *evalf*(%, 3)

$$\textit{DistanciaMax} := \frac{147\sqrt{3815} \left( \frac{49\sqrt{3815}}{654} + \frac{\sqrt{1037135}}{218} \right)}{200}$$

$$423.$$

(106)

> *TiempoAltura* := *solve*(*rhs*(*diff*(*SolucionVertical*, *t*)) = 0, *t*); *evalf*(%, 3)

$$\textit{TiempoAltura} := \frac{49\sqrt{3815}}{654}$$

$$4.63$$

(107)

> *AlturaMax* := *subs*(*t* = *TiempoAltura*, *rhs*(*SolucionVertical*)); *evalf*(%, 3)

$$\textit{AlturaMax} := \frac{17127}{160}$$

$$107.$$

(108)

>

>

> *restart*

Problema del arco recurvo y la flecha de ALUMINIO

Fase dinámica FLECHA 7

> *gravedad* :=  $\frac{981}{100}$ ; *Hooke* :=  $\frac{14}{\left(\frac{4}{10}\right)}$ ; *Peso* :=  $\frac{24}{1000}$

$$\textit{gravedad} := \frac{981}{100}$$

$$\textit{Hooke} := 35$$

$$\textit{Peso} := \frac{3}{125}$$

(109)

$$\begin{aligned} > \text{Ecuacion} := \text{diff}(s(t), t\$2) \cdot \left( \frac{\text{Peso}}{\text{gravedad}} \right) = -\text{Hooke} \cdot s(t) \\ & \text{Ecuacion} := \frac{4 \frac{d^2}{dt^2} s(t)}{1635} = -35 s(t) \end{aligned} \quad (110)$$

$$\begin{aligned} > \text{CondIni} := s(0) = -\frac{49}{100}, D(s)(0) = 0 \\ & \text{CondIni} := s(0) = -\frac{49}{100}, D(s)(0) = 0 \end{aligned} \quad (111)$$

$$\begin{aligned} > \text{SolucionParticular} := \text{dsolve}(\{\text{Ecuacion}, \text{CondIni}\}); \text{evalf}(\%, 4) \\ & \text{SolucionParticular} := s(t) = -\frac{49 \cos\left(\frac{5\sqrt{2289} t}{2}\right)}{100} \\ & s(t) = -0.4900 \cos(119.6 t) \end{aligned} \quad (112)$$

$$\begin{aligned} > \text{tiempo} := \text{solve}(\text{rhs}(\text{SolucionParticular}) = 0, t); \text{evalf}(\%, 3) \\ & \text{tiempo} := \frac{\pi \sqrt{2289}}{11445} \\ & 0.0131 \end{aligned} \quad (113)$$

$$\begin{aligned} > \text{Velocidad} := \text{subs}(t = \text{tiempo}, \text{rhs}(\text{diff}(\text{SolucionParticular}, t))); \text{evalf}(\%, 3) \\ & \text{Velocidad} := \frac{49 \sqrt{2289} \sin\left(\frac{\pi}{2}\right)}{40} \\ & 58.4 \end{aligned} \quad (114)$$

>  
Problema cinemático

$$\begin{aligned} > \text{Velocidad} \\ & \frac{49 \sqrt{2289}}{40} \end{aligned} \quad (115)$$

$$\begin{aligned} > \text{EcuacionVertical} := \text{diff}(y(t), t\$2) = -\text{gravedad} \\ & \text{EcuacionVertical} := \frac{d^2}{dt^2} y(t) = -\frac{981}{100} \end{aligned} \quad (116)$$

$$\begin{aligned} > \text{EcuacionHorizontal} := \text{diff}(x(t), t) = \text{Velocidad} \cdot \cos\left(\frac{\text{Pi}}{4}\right) \\ & \text{EcuacionHorizontal} := \frac{d}{dt} x(t) = \frac{49 \sqrt{2289} \sqrt{2}}{80} \end{aligned} \quad (117)$$

$$\begin{aligned} > \text{evalf}(\text{Pi}, 100) \\ & 3.1415926535897932384626433832795028841971693993751058209749445923078164062862 \backslash (118) \\ & 08998628034825342117068 \end{aligned}$$

$$\begin{aligned} > \text{CondVertical} := y(0) = 2, D(y)(0) = \text{Velocidad} \cdot \sin\left(\frac{\text{Pi}}{4}\right) \\ &\quad \text{CondVertical} := y(0) = 2, D(y)(0) = \frac{49 \sqrt{2289} \sqrt{2}}{80} \end{aligned} \quad (119)$$

$$\begin{aligned} > \text{CondHorizontal} := x(0) = 0 \\ &\quad \text{CondHorizontal} := x(0) = 0 \end{aligned} \quad (120)$$

$$\begin{aligned} > \text{SolucionVertical} := \text{dsolve}(\{\text{EcuacionVertical}, \text{CondVertical}\}); \text{evalf}(\%, 3) \\ &\quad \text{SolucionVertical} := y(t) = -\frac{981 t^2}{200} + \frac{49 \sqrt{4578} t}{80} + 2 \\ &\quad y(t) = -4.90 t^2 + 41.4 t + 2. \end{aligned} \quad (121)$$

$$\begin{aligned} > \text{SolucionHorizontal} := \text{dsolve}(\{\text{EcuacionHorizontal}, \text{CondHorizontal}\}); \text{evalf}(\%, 3) \\ &\quad \text{SolucionHorizontal} := x(t) = \frac{49 \sqrt{4578} t}{80} \\ &\quad x(t) = 41.4 t \end{aligned} \quad (122)$$

$$\begin{aligned} > \text{TiempoVuelo} := \text{solve}(\text{rhs}(\text{SolucionVertical}) = 0, t); \text{evalf}(\%, 3) \\ &\quad \text{TiempoVuelo} := \frac{245 \sqrt{4578}}{3924} - \frac{5 \sqrt{11242914}}{3924}, \frac{245 \sqrt{4578}}{3924} + \frac{5 \sqrt{11242914}}{3924} \\ &\quad -0.03, 8.47 \end{aligned} \quad (123)$$

$$\begin{aligned} > \text{DistanciaMax} := \text{subs}(t = \text{TiempoVuelo}[2], \text{rhs}(\text{SolucionHorizontal})); \text{evalf}(\%, 3) \\ &\quad \text{DistanciaMax} := \frac{49 \sqrt{4578} \left( \frac{245 \sqrt{4578}}{3924} + \frac{5 \sqrt{11242914}}{3924} \right)}{80} \\ &\quad 351. \end{aligned} \quad (124)$$

$$\begin{aligned} > \text{TiempoAltura} := \text{solve}(\text{rhs}(\text{diff}(\text{SolucionVertical}, t)) = 0, t); \text{evalf}(\%, 3) \\ &\quad \text{TiempoAltura} := \frac{245 \sqrt{4578}}{3924} \\ &\quad 4.22 \end{aligned} \quad (125)$$

$$\begin{aligned} > \text{AlturaMax} := \text{subs}(t = \text{TiempoAltura}, \text{rhs}(\text{SolucionVertical})); \text{evalf}(\%, 3) \\ &\quad \text{AlturaMax} := \frac{17191}{192} \\ &\quad 89.5 \end{aligned} \quad (126)$$

>

>

>

> restart

Problema del arco recurvo y la flecha de ALUMINIO  
Fase dinámica FLECHA 8

$$\begin{aligned}
 &> \text{gravedad} := \frac{981}{100}; \text{Hooke} := \frac{14}{\left(\frac{4}{10}\right)}; \text{Peso} := \frac{31}{1000} \\
 &\qquad \text{gravedad} := \frac{981}{100} \\
 &\qquad \text{Hooke} := 35 \\
 &\qquad \text{Peso} := \frac{31}{1000}
 \end{aligned} \tag{127}$$

$$\begin{aligned}
 &> \text{Ecuacion} := \text{diff}(s(t), t\$2) \cdot \left(\frac{\text{Peso}}{\text{gravedad}}\right) = -\text{Hooke} \cdot s(t) \\
 &\qquad \text{Ecuacion} := \frac{31 \frac{d^2}{dt^2} s(t)}{9810} = -35 s(t)
 \end{aligned} \tag{128}$$

$$\begin{aligned}
 &> \text{CondIni} := s(0) = -\frac{59}{100}, D(s)(0) = 0 \\
 &\qquad \text{CondIni} := s(0) = -\frac{59}{100}, D(s)(0) = 0
 \end{aligned} \tag{129}$$

$$\begin{aligned}
 &> \text{SolucionParticular} := \text{dsolve}(\{\text{Ecuacion}, \text{CondIni}\}); \text{evalf}(\%, 4) \\
 &\qquad \text{SolucionParticular} := s(t) = -\frac{59 \cos\left(\frac{15 \sqrt{47306} t}{31}\right)}{100} \\
 &\qquad s(t) = -0.5900 \cos(105.2 t)
 \end{aligned} \tag{130}$$

$$\begin{aligned}
 &> \text{tiempo} := \text{solve}(\text{rhs}(\text{SolucionParticular}) = 0, t); \text{evalf}(\%, 3) \\
 &\qquad \text{tiempo} := \frac{\pi \sqrt{47306}}{45780} \\
 &\qquad 0.0148
 \end{aligned} \tag{131}$$

$$\begin{aligned}
 &> \text{Velocidad} := \text{subs}(t = \text{tiempo}, \text{rhs}(\text{diff}(\text{SolucionParticular}, t))); \text{evalf}(\%, 3) \\
 &\qquad \text{Velocidad} := \frac{177 \sqrt{47306} \sin\left(\frac{\pi}{2}\right)}{620} \\
 &\qquad 61.8
 \end{aligned} \tag{132}$$

>  
Problema cinemático

$$\begin{aligned}
 &> \text{Velocidad} \\
 &\qquad \frac{177 \sqrt{47306}}{620}
 \end{aligned} \tag{133}$$

$$\begin{aligned}
 &> \text{EcuacionVertical} := \text{diff}(y(t), t\$2) = -\text{gravedad} \\
 &\qquad \text{EcuacionVertical} := \frac{d^2}{dt^2} y(t) = -\frac{981}{100}
 \end{aligned} \tag{134}$$



$$\begin{aligned} &> \text{EcuacionHorizontal} := \text{diff}(x(t), t) = \text{Velocidad} \cdot \cos\left(\frac{\text{Pi}}{4}\right) \\ &\text{EcuacionHorizontal} := \frac{d}{dt} x(t) = \frac{177 \sqrt{47306} \sqrt{2}}{1240} \end{aligned} \quad (135)$$

$$\begin{aligned} &> \text{evalf}(\text{Pi}, 100) \\ &3.1415926535897932384626433832795028841971693993751058209749445923078164062862 \backslash \quad (136) \\ &08998628034825342117068 \end{aligned}$$

$$\begin{aligned} &> \text{CondVertical} := y(0) = 2, D(y)(0) = \text{Velocidad} \cdot \sin\left(\frac{\text{Pi}}{4}\right) \\ &\text{CondVertical} := y(0) = 2, D(y)(0) = \frac{177 \sqrt{47306} \sqrt{2}}{1240} \end{aligned} \quad (137)$$

$$\begin{aligned} &> \text{CondHorizontal} := x(0) = 0 \\ &\text{CondHorizontal} := x(0) = 0 \end{aligned} \quad (138)$$

$$\begin{aligned} &> \text{SolucionVertical} := \text{dsolve}(\{\text{EcuacionVertical}, \text{CondVertical}\}); \text{evalf}(\%, 3) \\ &\text{SolucionVertical} := y(t) = -\frac{981 t^2}{200} + \frac{177 \sqrt{23653} t}{620} + 2 \\ &y(t) = -4.90 t^2 + 43.9 t + 2. \end{aligned} \quad (139)$$

$$\begin{aligned} &> \text{SolucionHorizontal} := \text{dsolve}(\{\text{EcuacionHorizontal}, \text{CondHorizontal}\}); \text{evalf}(\%, 3) \\ &\text{SolucionHorizontal} := x(t) = \frac{177 \sqrt{23653} t}{620} \\ &x(t) = 43.9 t \end{aligned} \quad (140)$$

$$\begin{aligned} &> \text{TiempoVuelo} := \text{solve}(\text{rhs}(\text{SolucionVertical}) = 0, t); \text{evalf}(\%, 3) \\ &\text{TiempoVuelo} := \frac{295 \sqrt{23653}}{10137} - \frac{115 \sqrt{158813}}{10137}, \frac{295 \sqrt{23653}}{10137} + \frac{115 \sqrt{158813}}{10137} \\ &-0.03, 8.99 \end{aligned} \quad (141)$$

$$\begin{aligned} &> \text{DistanciaMax} := \text{subs}(t = \text{TiempoVuelo}[2], \text{rhs}(\text{SolucionHorizontal})); \text{evalf}(\%, 3) \\ &\text{DistanciaMax} := \frac{177 \sqrt{23653} \left( \frac{295 \sqrt{23653}}{10137} + \frac{115 \sqrt{158813}}{10137} \right)}{620} \\ &393. \end{aligned} \quad (142)$$

$$\begin{aligned} &> \text{TiempoAltura} := \text{solve}(\text{rhs}(\text{diff}(\text{SolucionVertical}, t)) = 0, t); \text{evalf}(\%, 3) \\ &\text{TiempoAltura} := \frac{295 \sqrt{23653}}{10137} \\ &4.48 \end{aligned} \quad (143)$$

$$\begin{aligned} &> \text{AlturaMax} := \text{subs}(t = \text{TiempoAltura}, \text{rhs}(\text{SolucionVertical})); \text{evalf}(\%, 3) \\ &\text{AlturaMax} := \frac{24863}{248} \\ &100. \end{aligned} \quad (144)$$

>

>

>

> restart

Problema del arco recurvo y la flecha de PLASTICO

Fase dinámica FLECHA 9

>  $gravedad := \frac{981}{100}; Hooke := \frac{14}{\left(\frac{4}{10}\right)}; Peso := \frac{32}{1000}$

$$gravedad := \frac{981}{100}$$

$$Hooke := 35$$

$$Peso := \frac{4}{125}$$

(145)

>  $Ecuacion := \text{diff}(s(t), t\$2) \cdot \left(\frac{Peso}{gravedad}\right) = -Hooke \cdot s(t)$

$$Ecuacion := \frac{16 \frac{d^2}{dt^2} s(t)}{4905} = -35 s(t)$$

(146)

>  $CondIni := s(0) = -\frac{54}{100}, D(s)(0) = 0$

$$CondIni := s(0) = -\frac{27}{50}, D(s)(0) = 0$$

(147)

>  $SolucionParticular := \text{dsolve}(\{Ecuacion, CondIni\}); \text{evalf}(\%, 4)$

$$SolucionParticular := s(t) = -\frac{27 \cos\left(\frac{15 \sqrt{763} t}{4}\right)}{50}$$

$$s(t) = -0.5400 \cos(103.6 t)$$

(148)

>  $tiempo := \text{solve}(\text{rhs}(SolucionParticular) = 0, t); \text{evalf}(\%, 3)$

$$tiempo := \frac{2 \pi \sqrt{763}}{11445}$$

$$0.0152$$

(149)

>  $Velocidad := \text{subs}(t = tiempo, \text{rhs}(\text{diff}(SolucionParticular, t))); \text{evalf}(\%, 3)$

$$Velocidad := \frac{81 \sqrt{763} \sin\left(\frac{\pi}{2}\right)}{40}$$

$$55.8$$

(150)

>

Problema cinemático

> Velocidad

$$\frac{81 \sqrt{763}}{40} \quad (151)$$

> EcuacionVertical := diff(y(t), t\$2) = -gravedad

$$EcuacionVertical := \frac{d^2}{dt^2} y(t) = -\frac{981}{100} \quad (152)$$

> EcuacionHorizontal := diff(x(t), t) = Velocidad \* cos\left(\frac{\text{Pi}}{4}\right)

$$EcuacionHorizontal := \frac{d}{dt} x(t) = \frac{81 \sqrt{763} \sqrt{2}}{80} \quad (153)$$

> evalf(Pi, 100)

$$3.1415926535897932384626433832795028841971693993751058209749445923078164062862\backslash 08998628034825342117068 \quad (154)$$

> CondVertical := y(0) = 2, D(y)(0) = Velocidad \* sin\left(\frac{\text{Pi}}{4}\right)

$$CondVertical := y(0) = 2, D(y)(0) = \frac{81 \sqrt{763} \sqrt{2}}{80} \quad (155)$$

> CondHorizontal := x(0) = 0

$$CondHorizontal := x(0) = 0 \quad (156)$$

> SolucionVertical := dsolve({EcuacionVertical, CondVertical}); evalf(%, 3)

$$SolucionVertical := y(t) = -\frac{981 t^2}{200} + \frac{81 \sqrt{1526} t}{80} + 2$$

$$y(t) = -4.90 t^2 + 39.5 t + 2. \quad (157)$$

> SolucionHorizontal := dsolve({EcuacionHorizontal, CondHorizontal}); evalf(%, 3)

$$SolucionHorizontal := x(t) = \frac{81 \sqrt{1526} t}{80}$$

$$x(t) = 39.5 t \quad (158)$$

> TiempoVuelo := solve(rhs(SolucionVertical) = 0, t); evalf(%, 3)

$$TiempoVuelo := \frac{45 \sqrt{1526}}{436} - \frac{5 \sqrt{1140358}}{1308}, \frac{45 \sqrt{1526}}{436} + \frac{5 \sqrt{1140358}}{1308}$$

$$-0.06, 8.12 \quad (159)$$

> DistanciaMax := subs(t = TiempoVuelo[2], rhs(SolucionHorizontal)); evalf(%, 3)

$$DistanciaMax := \frac{81 \sqrt{1526} \left( \frac{45 \sqrt{1526}}{436} + \frac{5 \sqrt{1140358}}{1308} \right)}{80}$$

$$320. \quad (160)$$

> TiempoAltura := solve(rhs(diff(SolucionVertical, t)) = 0, t); evalf(%, 3)

$$TiempoAltura := \frac{45 \sqrt{1526}}{436}$$

4.03

(161)

>  $AlturaMax := subs(t = TiempoAltura, rhs(SolucionVertical)); evalf(\%, 3)$

$$AlturaMax := \frac{5231}{64}$$

81.7

(162)

&gt;

&gt;

&gt; restart

Problema del arco recurvo y la flecha de ALUMINIO

Fase dinámica FLECHA 10

>  $gravedad := \frac{981}{100}; Hooke := \frac{14}{\left(\frac{4}{10}\right)}; Peso := \frac{21}{1000}$

$$gravedad := \frac{981}{100}$$

$$Hooke := 35$$

$$Peso := \frac{21}{1000}$$

(163)

>  $Ecuacion := diff(s(t), t\$2) \cdot \left(\frac{Peso}{gravedad}\right) = -Hooke \cdot s(t)$

$$Ecuacion := \frac{7 \frac{d^2}{dt^2} s(t)}{3270} = -35 s(t)$$

(164)

>  $CondIni := s(0) = -\frac{51}{100}, D(s)(0) = 0$

$$CondIni := s(0) = -\frac{51}{100}, D(s)(0) = 0$$

(165)

>  $SolucionParticular := dsolve(\{Ecuacion, CondIni\}); evalf(\%, 4)$

$$SolucionParticular := s(t) = -\frac{51 \cos(5 \sqrt{654} t)}{100}$$

$$s(t) = -0.5100 \cos(127.8 t)$$

(166)

>  $tiempo := solve(rhs(SolucionParticular) = 0, t); evalf(\%, 3)$

$$tiempo := \frac{\pi \sqrt{654}}{6540}$$

0.0123

(167)

>  $Velocidad := subs(t = tiempo, rhs(diff(SolucionParticular, t))); evalf(\%, 3)$

$$Velocidad := \frac{51 \sqrt{654} \sin\left(\frac{\pi}{2}\right)}{20}$$

65.3

(168)

>

Problema cinemático

> Velocidad

$$\frac{51 \sqrt{654}}{20} \quad (169)$$

> EcuacionVertical := diff(y(t), t\$2) = -gravedad

$$EcuacionVertical := \frac{d^2}{dt^2} y(t) = -\frac{981}{100} \quad (170)$$

> EcuacionHorizontal := diff(x(t), t) = Velocidad \* cos\left(\frac{\text{Pi}}{4}\right)

$$EcuacionHorizontal := \frac{d}{dt} x(t) = \frac{51 \sqrt{654} \sqrt{2}}{40} \quad (171)$$

> evalf(Pi, 100)

$$3.1415926535897932384626433832795028841971693993751058209749445923078164062862\backslash \quad (172)$$
$$08998628034825342117068$$

> CondVertical := y(0) = 2, D(y)(0) = Velocidad \* sin\left(\frac{\text{Pi}}{4}\right)

$$CondVertical := y(0) = 2, D(y)(0) = \frac{51 \sqrt{654} \sqrt{2}}{40} \quad (173)$$

> CondHorizontal := x(0) = 0

$$CondHorizontal := x(0) = 0 \quad (174)$$

> SolucionVertical := dsolve({EcuacionVertical, CondVertical}); evalf(%, 3)

$$SolucionVertical := y(t) = -\frac{981 t^2}{200} + \frac{51 \sqrt{327} t}{20} + 2$$
$$y(t) = -4.90 t^2 + 46.2 t + 2. \quad (175)$$

> SolucionHorizontal := dsolve({EcuacionHorizontal, CondHorizontal}); evalf(%, 3)

$$SolucionHorizontal := x(t) = \frac{51 \sqrt{327} t}{20}$$
$$x(t) = 46.2 t \quad (176)$$

> TiempoVuelo := solve(rhs(SolucionVertical) = 0, t); evalf(%, 3)

$$TiempoVuelo := \frac{85 \sqrt{327}}{327} - \frac{5 \sqrt{96247}}{327}, \frac{85 \sqrt{327}}{327} + \frac{5 \sqrt{96247}}{327}$$
$$-0.03, 9.45 \quad (177)$$

> DistanciaMax := subs(t = TiempoVuelo[2], rhs(SolucionHorizontal)); evalf(%, 3)

$$DistanciaMax := \frac{51 \sqrt{327} \left( \frac{85 \sqrt{327}}{327} + \frac{5 \sqrt{96247}}{327} \right)}{20}$$
$$436. \quad (178)$$

>  $TiempoAltura := solve(rhs(diff(SolucionVertical, t)) = 0, t); evalf(\%, 3)$

$$TiempoAltura := \frac{85 \sqrt{327}}{327}$$

4.71

(179)

>  $AlturaMax := subs(t = TiempoAltura, rhs(SolucionVertical)); evalf(\%, 3)$

$$AlturaMax := \frac{883}{8}$$

110.

(180)

>

>

>

>

> restart

Problema del arco recurvo y la flecha de MADERA

Fase dinámica FLECHA 12

>  $gravedad := \frac{981}{100}; Hooke := \frac{14}{\left(\frac{4}{10}\right)}; Peso := \frac{30}{1000}$

$$gravedad := \frac{981}{100}$$

$$Hooke := 35$$

$$Peso := \frac{3}{100}$$

(181)

>  $Ecuacion := diff(s(t), t\$2) \cdot \left(\frac{Peso}{gravedad}\right) = -Hooke \cdot s(t)$

$$Ecuacion := \frac{\frac{d^2}{dt^2} s(t)}{327} = -35 s(t)$$

(182)

>  $CondIni := s(0) = -\frac{55}{100}, D(s)(0) = 0$

$$CondIni := s(0) = -\frac{11}{20}, D(s)(0) = 0$$

(183)

>  $SolucionParticular := dsolve(\{Ecuacion, CondIni\}); evalf(\%, 4)$

$$SolucionParticular := s(t) = -\frac{11 \cos(\sqrt{11445} t)}{20}$$

$$s(t) = -0.5500 \cos(107.0 t)$$

(184)

>  $tiempo := solve(rhs(SolucionParticular) = 0, t); evalf(\%, 3)$

$$tiempo := \frac{\pi \sqrt{11445}}{22890}$$

0.0147

(185)

>  $Velocidad := subs(t = tiempo, rhs(diff(SolucionParticular, t))); evalf(\%, 3)$

$$Velocidad := \frac{11 \sqrt{11445} \sin\left(\frac{\pi}{2}\right)}{58.8} \quad (186)$$

Problema cinemático

> Velocidad

$$\frac{11 \sqrt{11445}}{20} \quad (187)$$

> EcuacionVertical := diff(y(t), t\$2) = -gravedad

$$EcuacionVertical := \frac{d^2}{dt^2} y(t) = -\frac{981}{100} \quad (188)$$

> EcuacionHorizontal := diff(x(t), t) = Velocidad \* cos\left(\frac{\pi}{4}\right)

$$EcuacionHorizontal := \frac{d}{dt} x(t) = \frac{11 \sqrt{11445} \sqrt{2}}{40} \quad (189)$$

> evalf(Pi, 100)

$$3.1415926535897932384626433832795028841971693993751058209749445923078164062862\backslash 08998628034825342117068 \quad (190)$$

> CondVertical := y(0) = 2, D(y)(0) = Velocidad \* sin\left(\frac{\pi}{4}\right)

$$CondVertical := y(0) = 2, D(y)(0) = \frac{11 \sqrt{11445} \sqrt{2}}{40} \quad (191)$$

> CondHorizontal := x(0) = 0

$$CondHorizontal := x(0) = 0 \quad (192)$$

> SolucionVertical := dsolve({EcuacionVertical, CondVertical}); evalf(%, 3)

$$SolucionVertical := y(t) = -\frac{981 t^2}{200} + \frac{11 \sqrt{22890} t}{40} + 2$$

$$y(t) = -4.90 t^2 + 41.5 t + 2. \quad (193)$$

> SolucionHorizontal := dsolve({EcuacionHorizontal, CondHorizontal}); evalf(%, 3)

$$SolucionHorizontal := x(t) = \frac{11 \sqrt{22890} t}{40}$$

$$x(t) = 41.5 t \quad (194)$$

> TiempoVuelo := solve(rhs(SolucionVertical) = 0, t); evalf(%, 3)

$$TiempoVuelo := \frac{55 \sqrt{22890}}{1962} - \frac{5 \sqrt{2832474}}{1962}, \frac{55 \sqrt{22890}}{1962} + \frac{5 \sqrt{2832474}}{1962}$$

$$-0.05, 8.51 \quad (195)$$

> DistanciaMax := subs(t = TiempoVuelo[2], rhs(SolucionHorizontal)); evalf(%, 3)

$$DistanciaMax := \frac{11 \sqrt{22890} \left( \frac{55 \sqrt{22890}}{1962} + \frac{5 \sqrt{2832474}}{1962} \right)}{40}$$

$$355. \quad (196)$$

$$> \text{TiempoAltura} := \text{solve}(\text{rhs}(\text{diff}(\text{SolucionVertical}, t)) = 0, t); \text{evalf}(\%, 3)$$

$$\text{TiempoAltura} := \frac{55 \sqrt{22890}}{1962}$$

$$4.23 \quad (197)$$

$$> \text{AlturaMax} := \text{subs}(t = \text{TiempoAltura}, \text{rhs}(\text{SolucionVertical})); \text{evalf}(\%, 3)$$

$$\text{AlturaMax} := \frac{4331}{48}$$

$$90.2 \quad (198)$$

> restart

SOLUCIONES SINGULARES

$$> \text{Ecua} := 2 \cdot y \cdot (y' + 2) - x \cdot (y')^2 = 0$$

$$\text{Ecua} := 2 y(x) \left( \frac{d}{dx} y(x) + 2 \right) - x \left( \frac{d}{dx} y(x) \right)^2 = 0 \quad (199)$$

$$> \text{SolGral} := y(x) = \frac{(C - x)^2}{C}$$

$$\text{SolGral} := y(x) = \frac{(C - x)^2}{C} \quad (200)$$

$$> \text{ComprobarCero} := \text{simplify}(\text{eval}(\text{subs}(y(x) = \text{rhs}(\text{SolGral}), \text{Ecua})))$$

$$\text{ComprobarCero} := 0 = 0 \quad (201)$$

$$> \text{SolPartUno} := \text{subs}(C = 1, \text{SolGral})$$

$$\text{SolPartUno} := y(x) = (1 - x)^2 \quad (202)$$

$$> \text{SolPartDos} := \text{subs}(C = -3, \text{SolGral})$$

$$\text{SolPartDos} := y(x) = -\frac{(-3 - x)^2}{3} \quad (203)$$

$$> \text{SolPartTres} := \text{subs}(C = \sqrt{3}, \text{SolGral})$$

$$\text{SolPartTres} := y(x) = \frac{(\sqrt{3} - x)^2 \sqrt{3}}{3} \quad (204)$$

$$> \text{ComprobarUno} := \text{simplify}(\text{eval}(\text{subs}(y(x) = \text{rhs}(\text{SolPartUno}), \text{Ecua})))$$

$$\text{ComprobarUno} := 0 = 0 \quad (205)$$

$$> \text{ComprobarDos} := \text{simplify}(\text{eval}(\text{subs}(y(x) = \text{rhs}(\text{SolPartDos}), \text{Ecua})))$$

$$\text{ComprobarDos} := 0 = 0 \quad (206)$$

$$> \text{ComprobarTres} := \text{simplify}(\text{eval}(\text{subs}(y(x) = \text{rhs}(\text{SolPartTres}), \text{Ecua})))$$

$$\text{ComprobarTres} := 0 = 0 \quad (207)$$

$$> \text{SolSingularUno} := y(x) = -4 \cdot x$$

$$\text{SolSingularUno} := y(x) = -4 x \quad (208)$$



```

> ComprobarCuatro := simplify(eval(subs(y(x) = rhs(SolSingularUno), Ecua)))
ComprobarCuatro := 0 = 0 (209)
=
> SolSingularDos := y(x) = 0
SolSingularDos := y(x) = 0 (210)
=
> ComprobarCinco := simplify(eval(subs(y(x) = rhs(SolSingularDos), Ecua)))
ComprobarCinco := 0 = 0 (211)
=
> ConstanteTres := solve(rhs(SolGral) = rhs(SolPartTres), C) : ConstanteTres[2]
√3 (212)
=
> ConstanteSingular := solve(rhs(SolGral) = rhs(SolSingularUno), C) : ConstanteSingular[1];
ConstanteSingular[2];
-x
-x (213)
=
> restart
>

```