```
> restart:
```

Gegevens:

```
> m:=.5;
  g:=9.81;
  A:=20*10^(-4);
  theta:=25/360*(2*Pi);
  rho:=1.293;
  mu:=0.06695880134;
  nb_frames:= 35;
  Cd:='Cd';
```

$$m := 0.5$$

$$g := 9.81$$

$$A := \frac{1}{500}$$

$$\theta := \frac{5}{36}\,\pi$$

$$\rho := 1.293$$

$$\mu := 0.06695880134$$

$$nb\_frames := 35$$

$$Cd := Cd \tag{1}$$

Symbolische differentiaalvergelijking

```
> vgl_symb:=-'mu'*'m'*'g'*sin(Pi/2-'theta')-1/2*'rho'*'A'*diff(x
  (t),t)^2*'Cd'+'m'*'g'*cos(Pi/2-'theta')='m'*diff(x(t),t$2);
```

$$vgl\_symb := -\mu\,m\,g\,\cos(\theta) - \frac{1}{2}\,\rho\,A\left(\frac{d}{dt}\,x(t)\right)^2 Cd + m\,g\,\sin(\theta) = m\left(\frac{d^2}{dt^2}\,x(t)\right) \tag{2}$$

```
> vgl:=-mu*m*g*sin(Pi/2-theta)-1/2*rho*A*diff(x(t),t)^2*Cd+m*g*cos
  (Pi/2-theta)=m*diff(x(t),t$2);
```

$$vgl := -0.3284329206\,\sin\left(\frac{13}{36}\,\pi\right) - 0.001293000000\left(\frac{d}{dt}\,x(t)\right)^2 Cd + 4.905\,\cos\left(\frac{13}{36}\,\pi\right) \tag{3}$$

$$= 0.5\left(\frac{d^2}{dt^2}\,x(t)\right)$$

Opgelost met beginvoorwaarden

```
> dsolve({vgl,x(0)=0,D(x)(0)=0});
```

$$x(t) = \frac{1}{129300}\,\frac{1}{Cd}\left(\tag{4}\right.$$

$$-3\,t\sqrt{\left(-471848629262\,\sin\left(\frac{13}{36}\,\pi\right) + 7046850000000\,\cos\left(\frac{13}{36}\,\pi\right)\right) Cd}$$

$$+ 50000000\,\ln\left(\frac{1}{2}\,e^{\frac{3}{25000000}\,t\sqrt{\left(-471848629262\,\sin\left(\frac{13}{36}\,\pi\right) + 7046850000000\,\cos\left(\frac{13}{36}\,\pi\right)\right) Cd}}\right.$$

$$\left.\left.+ \frac{1}{2}\right)\right)$$

```
> convert( '(4)' , 'string' );
```

$$"x(t) = 1/129300*(-3*t*((-471848629262*\sin(13/36*Pi)+7046850000000*\cos(13/36*Pi))*Cd)^\wedge \quad \textbf{(5)}$$
$$(1/2)+50000000*\ln(1/2*\exp(3/25000000*t*((-471848629262*\sin(13/36*Pi)$$
$$+7046850000000*\cos(13/36*Pi))*Cd)^\wedge(1/2))+1/2))/Cd"$$

Deze vergelijking wordt in Excel ingevuld om de luchtweerstandscoëfficiënt Cd te vinden.