```
> # propagação de variâncias-covariâncias numa irradiada
incluindo incertezas nas medições lineares e angulares
> #
> with(LinearAlgebra):
> #
> M2:=M1+d*sin(R);
```

$$M2 := M1 + d\sin(R)$$

```
> P2:=P1+d*cos(R);
```

$$P2 := P1 + d\cos(R)$$

```
> sigma_obs:=Matrix([[s2d,0],[0,s2R]]);
```

$$sigma\_obs := \begin{bmatrix} s2d & 0 \\ 0 & s2R \end{bmatrix}$$

```
>
J:=Matrix([[diff(M2,d),diff(M2,R)],[diff(P2,d),diff(P2,R)]]);
```

$$J := \begin{bmatrix} \sin(R) & d\cos(R) \\ \cos(R) & -d\sin(R) \end{bmatrix}$$

```
> sigma_coord:=J.sigma_obs.Transpose(J);
```

$$sigma\_coord := \begin{bmatrix} \sin(R)^2\, s2d + d^2\cos(R)^2\, s2R & \sin(R)\, s2d\cos(R) - d^2\cos(\\ \sin(R)\, s2d\cos(R) - d^2\cos(R)\, s2R\sin(R) & \cos(R)^2\, s2d + d^2\sin(\end{bmatrix}$$

```
> Aux0:=ScalarMultiply(Matrix(2,2,shape=identity),-lambda);
```

$$Aux0 := \begin{bmatrix} -\lambda & 0 \\ 0 & -\lambda \end{bmatrix}$$

```
> Aux1:=Add(sigma_coord,Aux0);
```

$$Aux1 := \begin{bmatrix} \sin(R)^2\, s2d + d^2\cos(R)^2\, s2R - \lambda & \sin(R)\, s2d\cos(R) - d^2\cos(R)\, s2R \\ \sin(R)\, s2d\cos(R) - d^2\cos(R)\, s2R\sin(R) & \cos(R)^2\, s2d + d^2\sin(R)^2\, s2R - \end{bmatrix}$$

```
> Aux2:=Determinant(Aux1);
```

$$Aux2 := \sin(R)^4\, s2d\, d^2\, s2R - \sin(R)^2\, s2d\,\lambda + d^2\cos(R)^4\, s2R\, s2d - d^2\cos(R)^2\, s2R\,\lambda$$
$$- \lambda\cos(R)^2\, s2d - \lambda\, d^2\sin(R)^2\, s2R + \lambda^2 + 2\sin(R)^2\, s2d\cos(R)^2\, d^2\, s2R$$

```
> solve(Aux2=0,lambda);
```

$$s2d,\ d^2\, s2R$$