

GPCorrelation

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This widget allows to manage "**pseudo correlation**" or **covariance** matrices.

Why "**pseudo correlation**" ? In fact a real correlation matrix has its diagonal only with values of "1", the sigma values being given independantly. Here, we will consider a "**pseudo correlation**" with the diagonal filled with these sigma values !

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How to call it

For using the [GPCorrelation](#) class, the developer has only to create such an object as is:

```
gpCor = new GPCorrelation();
```

or:

```
gpCor = new GPCorrelation("widgetId", "MyMatrix");
```

Display

We will get:



By selecting the type of parameters, we may enter data for pseudo correlation/covariance matrices for Keplerian/Cartesian/**LOF** cartesian parameters. The different displays will be:

- In case of Keplerian parameters:

GPCorrelation

MyMatrix

Type of matrix: ☒ CORRELATION ☐ COVARIANCE (Reference: CORRELATION)

Type of parameters: * ☐ NONE ☒ KEPLERIAN ☐ CARTESIAN ☐ LOF

Sigma a: 0.0 m

Rho a/e: 0.0

Sigma e: 0.0

Rho a/i: 0.0

Rho e/i: 0.0

Sigma i: 0.0 deg

Rho a/w: 0.0

Rho e/w: 0.0

Rho i/w: 0.0

Sigma w: 0.0 deg

Rho a/Raan: 0.0

Rho e/Raan: 0.0

Rho i/Raan: 0.0

Rho w/Raan: 0.0

Sigma Raan: 0.0 deg

Rho a/v: 0.0

Rho e/v: 0.0

Rho i/v: 0.0

Rho w/v: 0.0

Rho Raan/v: 0.0

Sigma v: 0.0 deg

- In case of cartesian parameters:

GPCorrelation

MyMatrix

Type of matrix: ☒ CORRELATION ☐ COVARIANCE (Reference: CORRELATION)

Type of parameters: * ☐ NONE ☐ KEPLERIAN ☒ CARTESIAN ☐ LOF

Sigma x: 0.0 m

Rho x/y: 0.0

Sigma y: 0.0 m

Rho x/z: 0.0

Rho y/z: 0.0

Sigma z: 0.0 m

Rho x/vx: 0.0

Rho y/vx: 0.0

Rho z/vx: 0.0

Sigma vx: 0.0 m/s

Rho x/vy: 0.0

Rho y/vy: 0.0

Rho z/vy: 0.0

Rho vx/vy: 0.0

Sigma vy: 0.0 m/s

Rho x/vz: 0.0

Rho y/vz: 0.0

Rho z/vz: 0.0

Rho vx/vz: 0.0

Rho vy/vz: 0.0

Sigma vz: 0.0 m/s

- In case of **LOF** cartesian parameters:

GPCorrelation

MyMatrix

Type of matrix: ☒ CORRELATION ☐ COVARIANCE (Reference: CORRELATION)

Type of parameters: * ☐ NONE ☐ KEPLERIAN ☐ CARTESIAN ☒ LOF

LOF types: QSW

Absolute velocity: ☒

Sigma x: 0.0 m

Rho x/y: 0.0

Sigma y: 0.0 m

Rho x/z: 0.0

Rho y/z: 0.0

Sigma z: 0.0 m

Rho x/vx: 0.0

Rho y/vx: 0.0

Rho z/vx: 0.0

Sigma vx: 0.0 m/s

Rho x/vy: 0.0

Rho y/vy: 0.0

Rho z/vy: 0.0

Rho vx/vy: 0.0

Sigma vy: 0.0 m/s

Rho x/vz: 0.0

Rho y/vz: 0.0

Rho z/vz: 0.0

Rho vx/vz: 0.0

Rho vy/vz: 0.0

Sigma vz: 0.0 m/s

So we may have a covariance matrix rather than a pseudo correlation one:

GPCorrelation

MyMatrix

Type of matrix: * ☐ CORRELATION ☒ COVARIANCE (Reference: COVARIANCE)

Type of parameters: * ☐ NONE ☐ KEPLERIAN ☐ CARTESIAN ☒ LOF

LOF types: QSW

Absolute velocity: ☒

Sigma**2 x: 0.0 m^2

Rho Sigma Sigma x/y: 0.0 m^2

Sigma**2 y: 0.0 m^2

Rho Sigma Sigma x/z: 0.0 m^2

Rho Sigma Sigma y/z: 0.0 m^2

Sigma**2 z: 0.0 m^2

Rho Sigma Sigma x/vx: 0.0 m.m/s

Rho Sigma Sigma y/vx: 0.0 m.m/s

Rho Sigma Sigma z/vx: 0.0 m.m/s

Sigma**2 vx: 0.0 m^2/s^2

Rho Sigma Sigma vx/vy: 0.0 m^2/s^2

Sigma**2 vy: 0.0 m^2/s^2

Rho Sigma Sigma vx/vz: 0.0 m^2/s^2

Rho Sigma Sigma vy/vz: 0.0 m^2/s^2

Sigma**2 vz: 0.0 m^2/s^2

If the initial pseudo correlation (resp. covariance) matrix is not null, a specific pop-up window will appear to ask for the type of conversion. A bit as for the [GPORbit](#) widget, it will be possible to do this conversion between pseudo correlation and covariance matrices (but not between the different type of parameters) using a kind of “pivot” notion.

Change matrix type

What do you want to do ?

- Convert initial data (CORRELATION) but keep initial data as reference
- Convert initial data (CORRELATION) and use them them as reference
- Change type and reset data
- Cancel operation

Convert and Keep Convert and Use Reset Cancel

GPCorrelation

MyMatrix

Type of matrix: ☒ CORRELATION ☐ COVARIANCE (Reference: CORRELATION)

Type of parameters: * ☐ NONE ☒ KEPLERIAN ☐ CARTESIAN ☐ LOF

Sigma a *: 100.0 m

Rho a/e: 0.0

Sigma e *: 0.001

Rho e/i: 0.0

Sigma i *: 1.0 deg

Rho i/w: 0.0

Sigma w: 0.0 deg

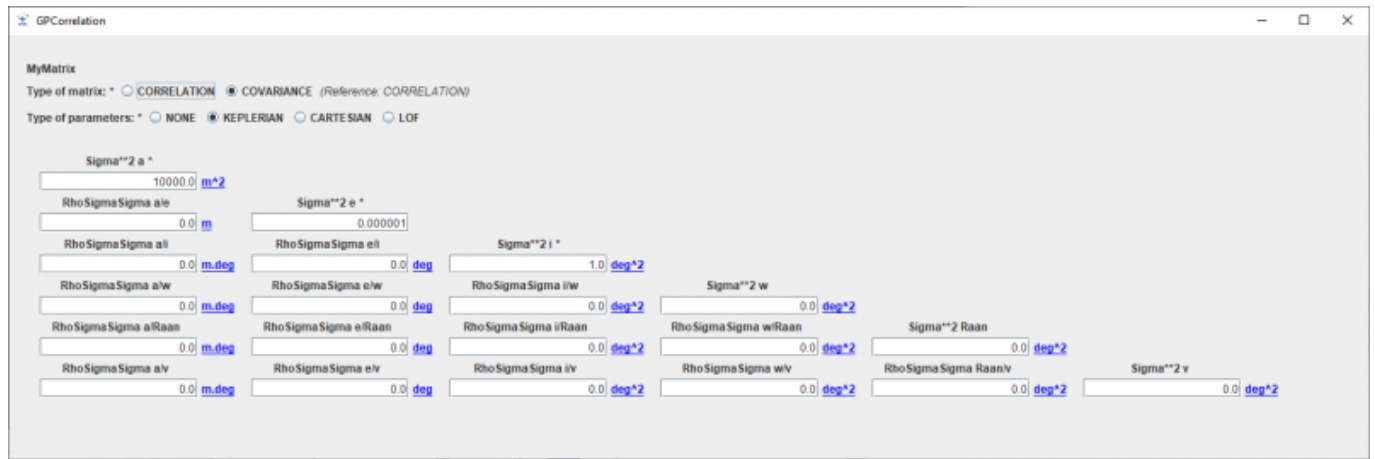
Rho w/Raan: 0.0

Sigma Raan: 0.0 deg

Rho Raan/v: 0.0

Sigma v: 0.0 deg

=>



How to use it

There are no exactly corresponding correlation/covariance matrices inside [PATRIUS](#) but **GENOPUS** gives some utility classes and methods to use them.

In the examples below, we can recover the widget data inside [PATRIUS](#) [RealMatrix](#) or [Realvector](#) objects.

```
final GPCorrelationData data = gpCor.getGpCorrelationData();

final RealMatrix corMat = data.getCorrelationMatrix();
final RealMatrix covMat = data.getCovarianceMatrix();
final RealMatrix sqrtRootcovMat = data.getSqrtCovarianceMatrix();
final RealVector sigma = data.getSigma();
```

We have also the possibility to use these utility methods:

```
final RealMatrix mat1 = GPCorrelationUtils.corToCov(sigma, corMat);
final RealMatrix mat2 = GPCorrelationUtils.pseudoCorToCov(corMat);
final RealMatrix mat3 = GPCorrelationUtils.covToPseudoCor(covMat);
```

How it is stored

Here is an example of the [XML](#) format:

```
<!--Type of matrix:-->
<String name="matrixType">CORRELATION</String>
<!--Type of parameters:-->
<String name="type">LOF</String>
<!--LOF types:-->
<String name="lofType">LVLH</String>
<!--Absolute velocity:-->
<Boolean name="velocityType">true</Boolean>
<Real name="Sigma_x" unit="m">1.0E1</Real>
<Real name="Rho_x/y">5.0E-1</Real>
<Real name="Rho_x/z">0.0E0</Real>
```

```
<Real name="Rho_x/vx">0.0E0</Real>
<Real name="Rho_x/vy">0.0E0</Real>
<Real name="Rho_x/vz">0.0E0</Real>
<Real name="Sigma_y" unit="m">2.0E4</Real>
<Real name="Rho_y/z">0.0E0</Real>
<Real name="Rho_y/vx">0.0E0</Real>
<Real name="Rho_y/vy">0.0E0</Real>
<Real name="Rho_y/vz">0.0E0</Real>
<Real name="Sigma_z" unit="m">3.0E4</Real>
<Real name="Rho_z/vx">0.0E0</Real>
<Real name="Rho_z/vy">0.0E0</Real>
<Real name="Rho_z/vz">0.0E0</Real>
<Real name="Sigma_vx" unit="m/s">1.0E2</Real>
<Real name="Rho_vx/vy">0.0E0</Real>
<Real name="Rho_vx/vz">0.0E0</Real>
<Real name="Sigma_vy" unit="m/s">2.0E2</Real>
<Real name="Rho_vy/vz">0.0E0</Real>
<Real name="Sigma_vz" unit="m/s">3.0E2</Real>
```

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