

## Documentation of the MATLAB function ProjDirectMV.m

The function's arguments and returned quantities are listed in the help section of the function which is reproduced below.

```
function [prest,prvar] =ProjDirectMV(x,Gi)
% projects time series missing values onto observed for m by n series x
% Uses inverse covariance matrix Gi of x taken by columns of x giving blocks of size mxm
% Solves equations directly for the missing values in terms of know series values
% prest is the original series with missing values replaced by projected
% prvar has same with zeros except variances in place of missing values
```

To be specific, the given array  $\mathbf{x}$  of size  $m \times n$ , which is determined in the function, has elements  $x_{i,t}$  for  $i = 1 \dots m, t = 1 \dots n$  that contain the values  $x_{i,t}$  of stationary times series with lagged covariances

$$\Gamma_{i,j,k} = \text{Cov}(x_{i,t}, x_{j,t-k}).$$

Any desired (strict) subset of elements of  $\mathbf{x}$  may be set to **NaN** as indicating unknown values to be predicted by the function from the complementary set of elements (which should not be empty).

The square array  $\mathbf{Gi}$  should then be of size  $mn$  with elements  $\mathbf{Gi}(i, j)$  that are the elements of the matrix  $G^{-1}$ , where  $G$  is the covariance matrix of  $(x'_1, x'_2, \dots, x'_n)'$  and therefore has elements

$$G_{u,v} = \text{Cov}(x_{i,s}, x_{j,t}) = \Gamma_{i,j,s-t}$$

where  $u = (s - 1)m + i$  and  $v = (t - 1)m + j$  for  $i, j = 1 \dots m$  and  $s, t = 1 \dots n$ .

The returned array **prest** is identical to  $\mathbf{x}$  except that the missing (unknown) values are replaced by their minimum error variance linear predictions (or projections) from the supplied (known) values.

The returned array **prvar** is identical in size to  $\mathbf{x}$  and contains, where  $\mathbf{x}$  had missing values, the (minimum error) variance of those values. Elsewhere, the elements of **prvar** are set to zero.