

Abstract: We consider the estimation and inference of precision matrices of a rich class of locally stationary linear and nonlinear time series assuming that only one realization of the time series is observed. Using a Cholesky decomposition technique, we show that the precision matrices can be directly estimated via a series of least squares linear regressions with smoothly time-varying coefficients. The method of sieves is utilized for the estimation and is shown to be optimally adaptive in terms of estimation accuracy and efficient in terms of computational complexity. We establish an asymptotic theory for a class of L2 tests based on the nonparametric sieve estimators. The latter are used for testing whether the precision matrices are diagonal or banded. A Gaussian approximation result is established for a wide class of quadratic forms of non-stationary and possibly nonlinear processes of diverging dimensions, which is of interest by itself.