

3rd AssignmentPrincipal Component Analysis

1. For the previous problem we perform 100 system evaluations for different realizations of $E(x)$ and P . The calculations are shown in the Mathematica notebook.
2. Using these 100 system evaluations we create a matrix V of dimensions 100×902 where each row is one evaluation. Then we find the eigenvalues of $V^T V$. By keeping only eigenvalues greater than 10^{-15} , we can reduce the dimensions of the matrix from 902×902 to 15×15 .

KGLOBAL

Therefore, now the `Inverse[K] . F` command inverts a 15×15 matrix instead of a 902×902 one, reducing the calculation time significantly.

The system is now reduced to $K_{red} U_{red} = F_{red}$.

3. Performing 5000 Monte Carlo simulations on the reduced system we obtain the histogram for U_{PCA} , which is shown in the notebook. Also, a comparison between U and U_{PCA} is shown.
4. For the first calculation, the time used was 690 seconds while for the second it was roughly 330 seconds. So we have a computational gain of roughly 360 seconds. Therefore, we have a decrease of computational time of approximately 52%.