3. Power Spectral Density Estimation

3.1 Autocorrelation sequence and PSD

Write a MATLAB script to compute and plot the autocorrelation sequence of a white noise sequence of length $N = 100$ generated by the M-file ***randn***.

Use the M-file ***xcorr*** with the options **'biased'** and **'unbiased'** for a biased and an unbiased estimate of the autocorrelation sequence, respectively.

Compute and plot the PSD of the two autocorrelation estimates based on the FFT. Inspect the results and explain the main differences between the biased and the unbiased ones.

3.2 Periodogram analysis and Welch method

Write a script to verify the plots given in the lecture slides of chapter 2.5. Choose your own parameter values.

Hint: Use the functions ***periodogram*** and ***pwelch***.

3.3 Blackman-Tukey method

Write a script to verify the plots given in the lecture slides of chapter 2.6. Choose your own parameter values.

3.4 Yule-Walker method

Write a script to verify the plots given in the lecture slides of chapter 2.8. Choose your own parameter values.

Hint: Use the function ***pyulear***.

3.5 Burg method

Write a function for Burg‘s algorithm (***burgalg***) to estimate the reflection coefficients, the AR-model coefficients, and the error variance.

Use the functions ***arburg*** and ***pburg*** to check your code.

Verify the plots given in the lecture slides of chapter 2.9.

3.6 Simulink simulation of PSD estimation methods

The Simulink model ***psdcomp.slx*** simulates and displays the PSD estimates of a signal using different PDS estimation methods. The results are compared to a reference.

Inspect the blocks, simulate and observe the simulation results.

Change the parameters in the blocks and observe the results.