Project DSP — Spectral Analysis and Digital Filters

A. Find spectral components of the given EEG signal segment and apply digital filters to remove the frequency component of 50 Hz. Given signal EEG_19noise.MAT was acquired with the sampling frequency of $f_s = 200\,Hz$. Apply the low-pass ($f_c = 45\,Hz$) and the stop-band filter ($f_{c1} = 45\,Hz$ $f_{c2} = 55\,Hz$) and

- use FIR filters of order 30, 40, 50, and 60 to reject the noise component,
- compare results obtained by FIR filters with those by the Butterworth IIR filter of the 4th order and evaluate their percentage error related to Butterworth filtering,
- apply filtration in the frequency domain as well.

Use one of the following channels and given ranges:

DSP3.1	Channel 3, range 3001-3500	DSP3.7	Channel 8, range 3001-4000
DSP3.2	Channel 8, range 3001-3500	DSP3.8	Channel 16, range 4001-5000
DSP3.3	Channel 16, range 4001-4500	DSP3.9	Channel 17, range 4001-5000
DSP3.4	Channel 17, range 4001-4500	DSP3.10	Channel 19, range 4001-5000
DSP3.5	Channel 19, range 4001-4500	DSP3.11	Channel 17, range 5001-5500
DSP3.6	Channel 3, range 3001-4000	DSP3.12	Channel 19, range 3001-4000

B. Remove simulated noise components added to the MR image of the backbone MRpater004.MAT using chosen digital filters in the following steps:

- add simulated noise and evaluate image spectrum,
- reject noise component for selected filters and evaluate the percentage error of the denoised image related to the the original one.