GMWM Workshop - EUROCOW 2016
Exercise Sheet

February 10, 2016

1 Signal simulation

1. Simulate a signal from a model made by a Gauss-Markov process (with $\beta = 0.5$, $v^2 = 5 \cdot 10^{-4}$) plus White Noise process (with $\sigma^2 = 0.01$) of length 1 million and frequency 100Hz. For this purpose, look for the function `gen.gts` in the help files of the `gmwm` package. Save this signal in an object called "`sim`".

2. Plot the log-log plot of the wavelet variance of this simulated signal (`sim`).

2 Loading IMU data

You can find the IMU data at the following link: `https://enacshare.epfl.ch/dUpePHSdYxcqE65GWTXvB`. Download them and save them in the repository you are working in.

1. Load the IMU data coming from an IMAR sensor contained in the file "`fsas_imar_short_32min.imu`" saving it into an object called "`example.1`". Check if it is considered as an `imu` object using the function `is.imu()`.

2. Plot the wavelet variance of the second column of `example.1` (Y-gyroscope). For this purpose, save the second column into an object called "`gyro.y`". Estimate the robust wavelet variance and visually compare it with the standard one using the function `compare.wvar()`. Can we overlap the plots to have a different comparision? Should we use a robust GMWM?

3. Load the IMU data coming from an MTiG sensor contained in the file "`mtig_xsens_30min.txt`" saving it into an object called "`example.2`". Since this type of IMU data is not currently supported for the function `read.imu()`, use the function `read.table()` to load this data (look for

help for this function by executing `?read.table`). Remember to specify the parameter `row.names=1` to indicate that the first column in the file simply contains the epochs (i.e. name for each row) and is not a signal.

3 Modelling signals

1. Let us start to model the first column of `example.2` (X-gyroscope) by saving it into an object called "`gyro.x`". Plot the log-log plot of its wavelet variance to understand what models could describe it.

2. Starting from a Gauss-Markov plus White Noise process, check which model(s) fit the signal `gyro.x` best by using `plot()` and `compare.models()`.

3. Check the estimated parameters of one of the models by using the syntax "`$estimate`" at the end of the object in which the model is stored.

4. Obtain confidence intervals (i.e. inference) for them by using the help for the function `summary()`.

4 Selecting a model

1. Select a model for the `gyro.x` signal to be used in a navigation filter using the function `auto.imu()`.

2. Plot the result of the model selection procedure.

3. Do the same procedure on `gyro.y` from the `example.1` data.