Exercise: Identification of a parametric plant model in the frequency domain using periodic excitations.

The goal of this exercise is to make a complete identification run using the FDIDENT toolbox. This toolbox can be freely downloaded from http://home.mit.bme.hu/~kollar/fdident/index.html

A. Setup of the excercise: generate the data in matlab

1) Generate the system G_0:

```
[b0,a0] = cheby1(2,10,2*0.25);b0(2) = b0(2)*1.3;
```

2) Define the noise generating filter:

```
[bNoise,aNoise] = butter(1,2*0.2);
bNoise = bNoise+0.1*aNoise;
```

3) Generate a zero mean random phase multisine with a period length $N = 1024$ points, and with a flat amplitude spectrum up to 1/3th of the sample frequency (the sample frequency can be normalized to be equal to 1).
Scale the rms value of the signal to be equal to 1, and generate $M = 7 + 1$ periods.

The first $N_{\text{Trans}} = 1024$ points of the simulation period are used to eliminate all transient effects in the simulation. Check for the presence of transient effects by subtraction the last period from the first period of the data.

4) Generate $y_0, v(t)$: $y(t) = G_0(q)u_0 + v(t)$ with $v(t) = 0{,}1G_{\text{noise}}(q)e(t)$ filtered white noise $e(t) \sim N(0, 1)$. Eliminate the first N_{Trans} data points so that 7 periods remain. Verify that no visible transients are present.

5) Generate a time domain object that can be imported by FDIDENT, normalizing the sample frequency equal to 1:

```
ExpData = tiddata(y(:),u0(:),1);
```

B. Start the GUI of FDIDENT

Type `fdident` in the command window.

Select in the top bar the following options i) the advanced user level, ii) periodic signals, iii) linear analysis.

C. Task

1) Identify the system starting from the simulated data, following the same steps as in the illustration discussed during the lesson. Report/discuss the results of the intermediate steps, including a nonparametric noise analysis, selection of the model, discussion of the results, analysis of the residuals, ...

2) Discuss what happens if the model complexity is too small or too high, and how this can be detected. Check the impact of the model complexity on the estimated poles and zeros. What happens if the model complexity is too high?

3) Provide a pdf-file of your rapport, including snapshots of your results.