

Extra Content for: Rolf Isermann, Marco Münchhof:
Identification of Dynamic Systems.
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Experimental Data of the Three-Mass Oscillator

Overview of the Downloadable Data



Important Remarks (1/2)

These data **should only be used as companion data for the book Identification of Dynamic Systems**. Using these data without a profound knowledge of the identification methods as described in the book will lead to **useless and/or erroneous results**.

The given measurements of the Three-Mass Oscillator **must be pre-processed** in order to obtain optimal results.

The measurements have furthermore been sampled with very small sample times in order to allow the user to downsample the data and hence adjust the sample rate and investigate the influence of the sample time on the results. **Using the data directly with such heavy oversampling can result in numerical problems.**



Important Remarks (2/2)

Some measurements have been conducted **on purpose** in such a **way that they do not provide useful results** as e.g. the input sequence does not excite the relevant system dynamics.

Please consult the appropriate sections in the book to see detailed discussions of the suitability of the input sequences.

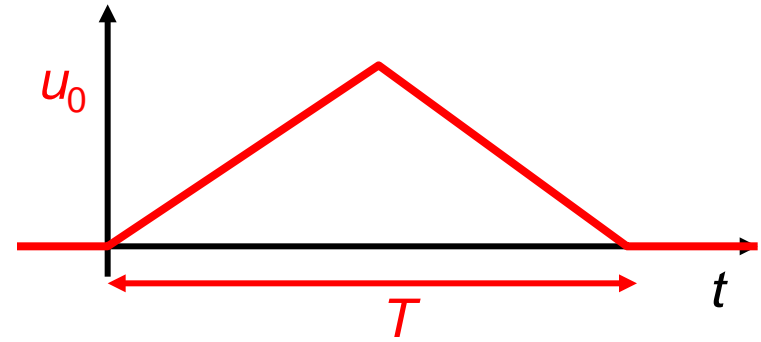
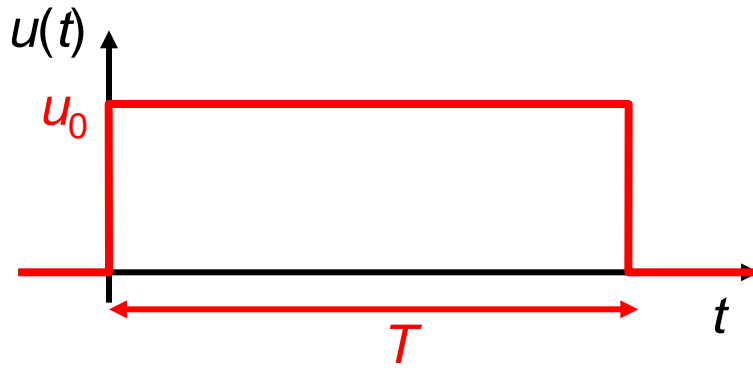


File Structure

Variable	Name	Variable	Name
Time	time	Motor Torque	MM
φ_1	phi1	$d\varphi_1 / dt$	dphi1
φ_2	phi2	$d\varphi_2 / dt$	dphi2
φ_3	phi3	$d\varphi_3 / dt$	dphi3
Sample Time	T0	Factor μ for PRBS	mue



Non-Periodic Test Signals



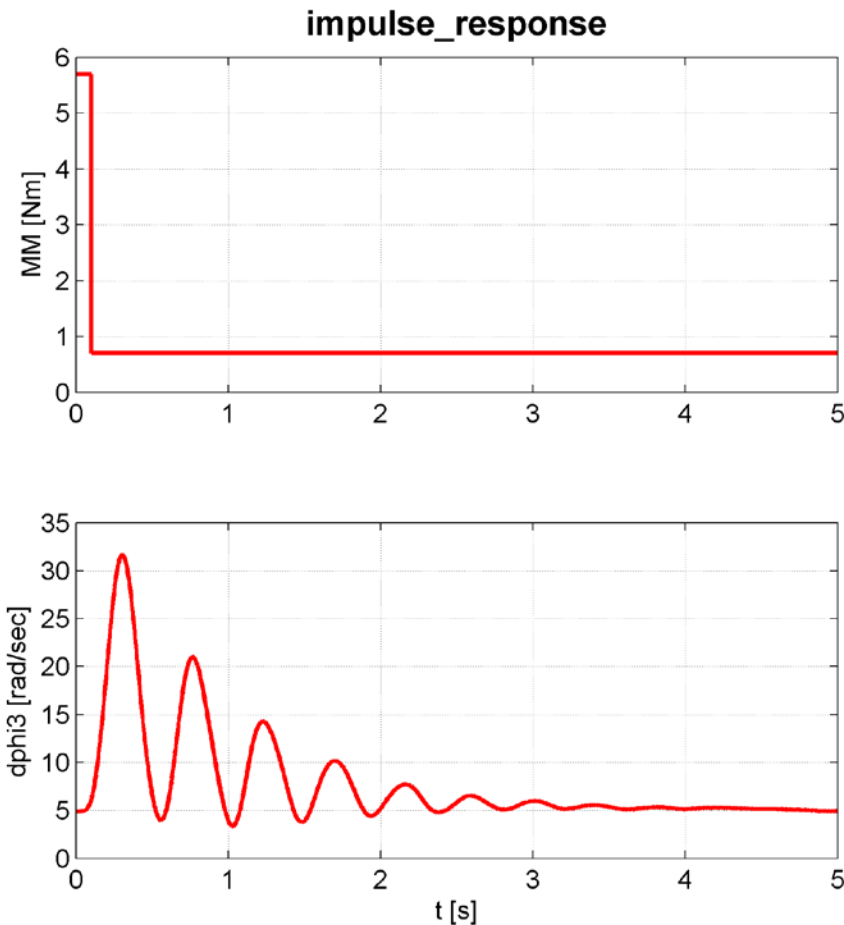
Impulse

Excitation: Impulse, i.e. approximation by a short step of duration 0.1s and height 5 Nm over an offset of 0.7 Nm (total height 5.7 Nm). The impulse response is measured for comparison with methods that provide an impulse response as a model.

Sample Time: 0.003 s

Files:

- impulse_response



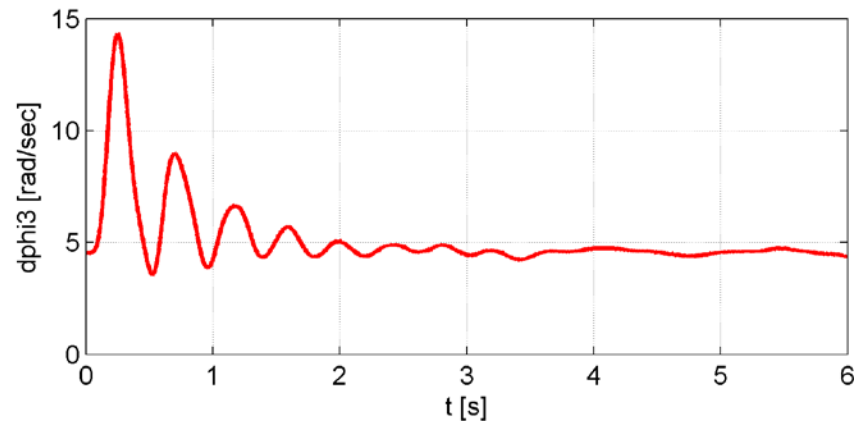
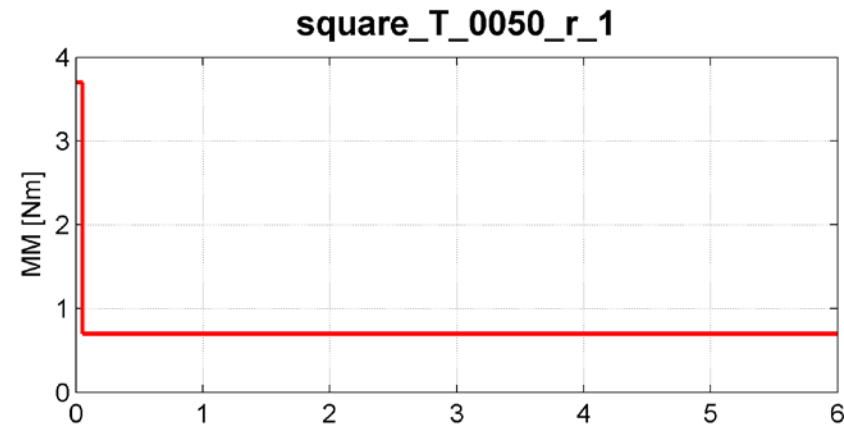
Square Pulse 0.05 s

Excitation: Square pulse of length 0.05 s and height 3 Nm over an offset of 0.7 Nm (total height 3.7 Nm)

Sample Time: 0.003 s

Files:

- square_T_0050_r_1



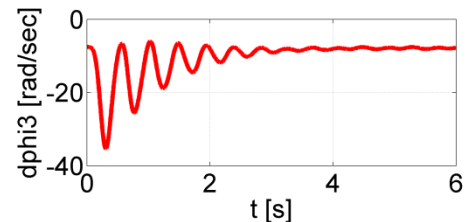
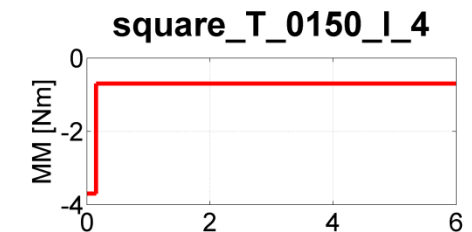
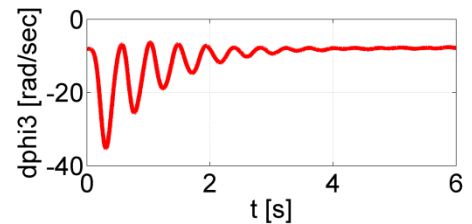
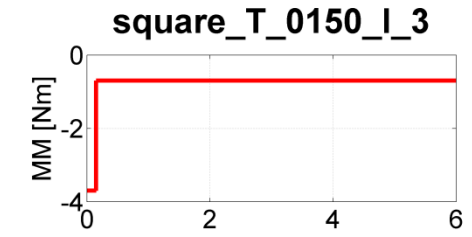
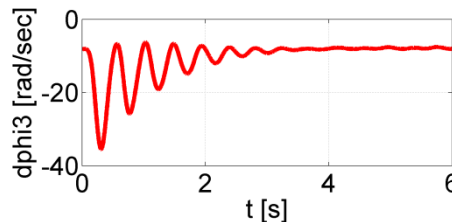
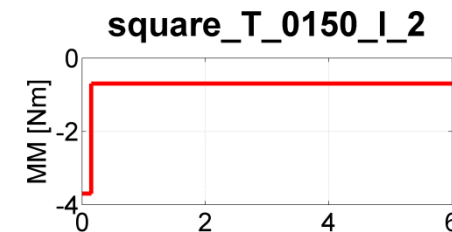
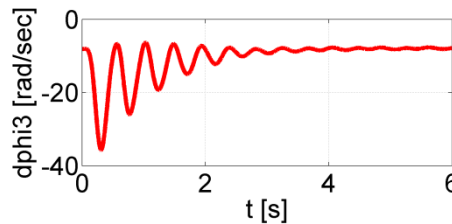
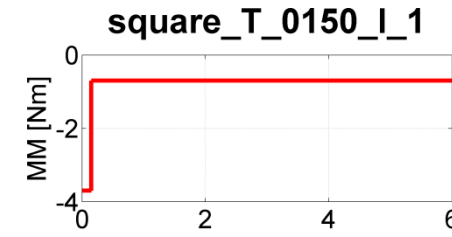
Negative Square Pulse 0.15 s (1/2)

Excitation: Negative square pulse of length 0.15 s and height -3 Nm over an offset of -0.7 Nm (total height -3.7 Nm)

Sample Time: 0.003 s

Files:

- square_T_0150_l_1
- square_T_0150_l_2
- square_T_0150_l_3
- square_T_0150_l_4



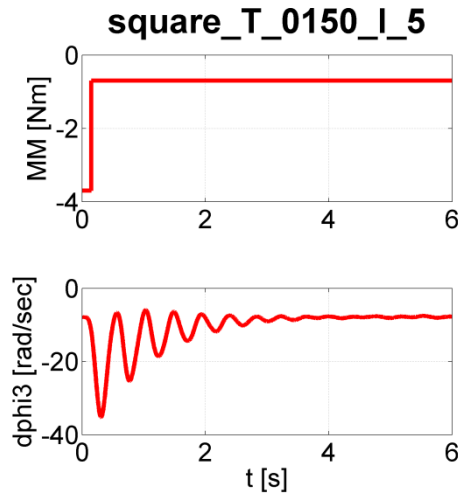
Negative Square Pulse 0.15 s (2/2)

Excitation: Negative square pulse of length 0.15 s and height -3 Nm over an offset of -0.7 Nm (total height -3.7 Nm)

Sample Time: 0.003 s

Files:

- square_T_0150_1_5



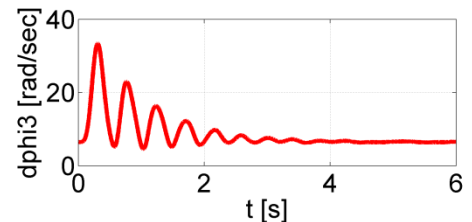
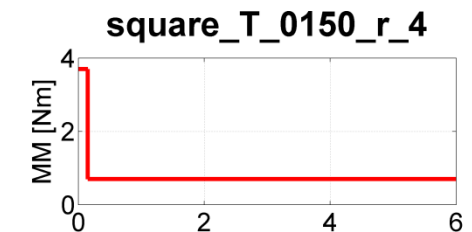
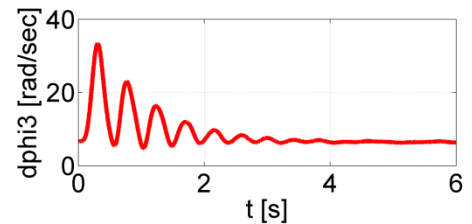
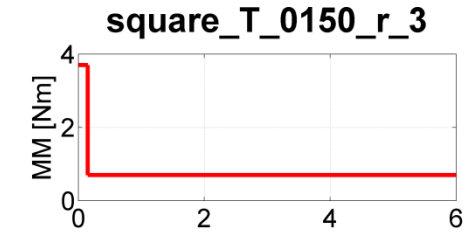
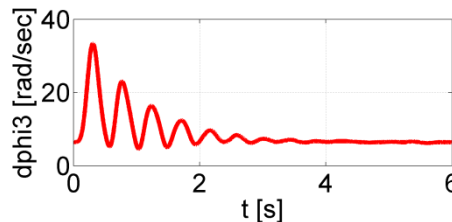
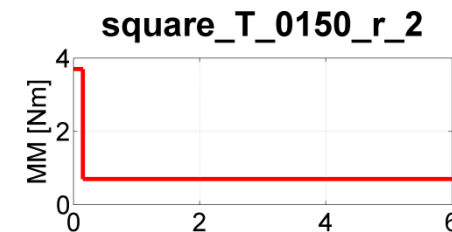
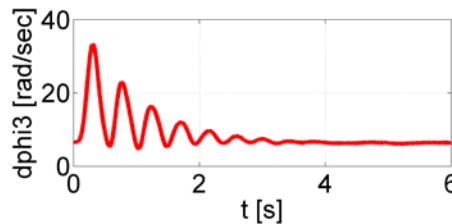
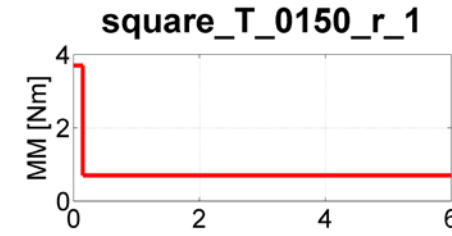
Square Pulse 0.15 s (1/2)

Excitation: Square pulse of length 0.15 s and height 3 Nm over an offset of 0.7 Nm (total height 3.7 Nm)

Sample Time: 0.003 s

Files:

- square_T_0150_r_1
- square_T_0150_r_2
- square_T_0150_r_3
- square_T_0150_r_4



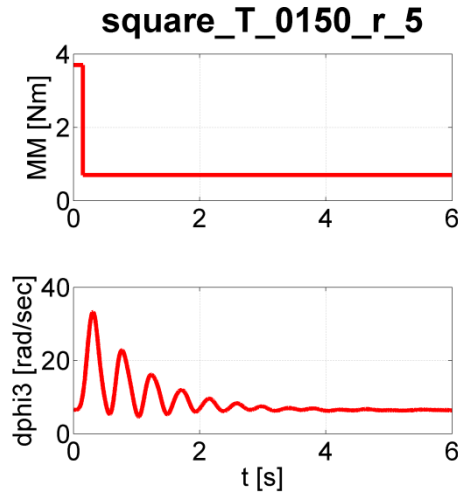
Square Pulse 0.15 s (2/2)

Excitation: Square pulse of length 0.15 s and height 3 Nm over an offset of 0.7 Nm (total height 3.7 Nm)

Sample Time: 0.003 s

Files:

- square_T_0150_r_5



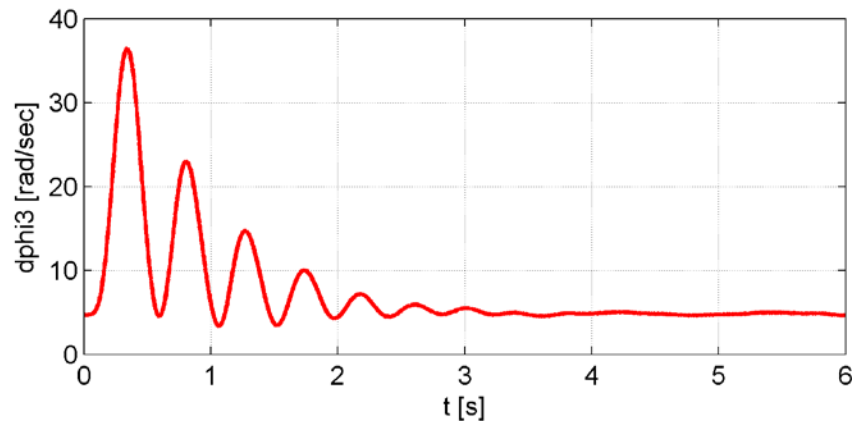
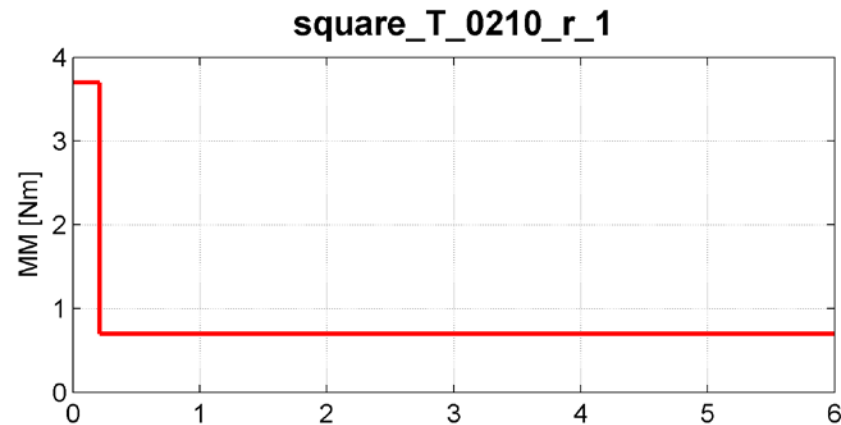
Square Pulse 0.21 s

Excitation: Square pulse of length 0.21 s and height 3 Nm over an offset of 0.7 Nm (total height 3.7 Nm)

Sample Time: 0.003 s

Files:

- square_T_0210_r_1



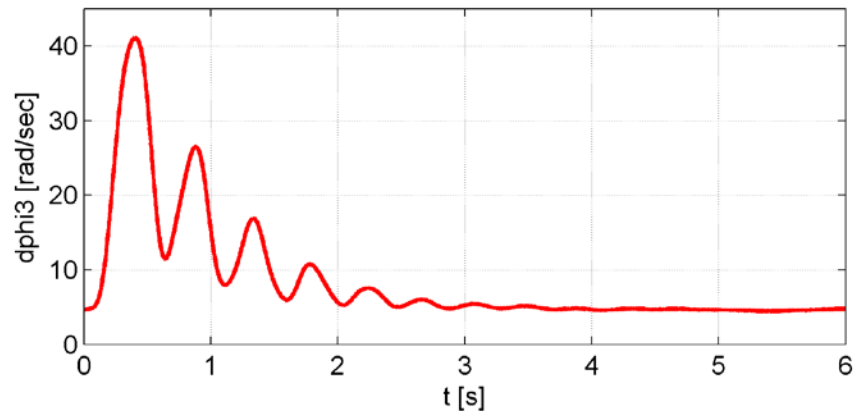
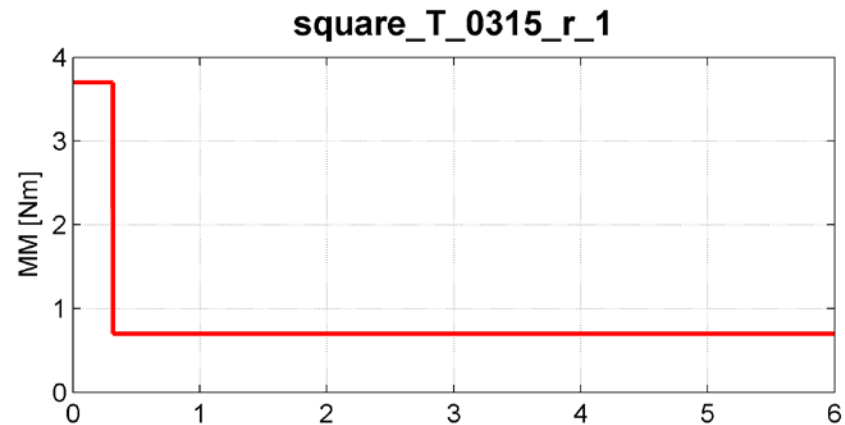
Square Pulse 0.315 s

Excitation: Square pulse of length 0.315 s and height 3 Nm over an offset of 0.7 Nm (total height 3.7 Nm)

Sample Time: 0.003 s

Files:

- square_T_0315_r_1



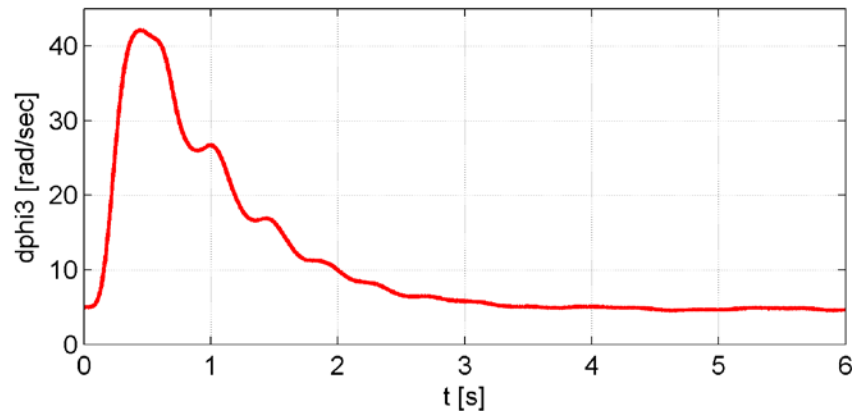
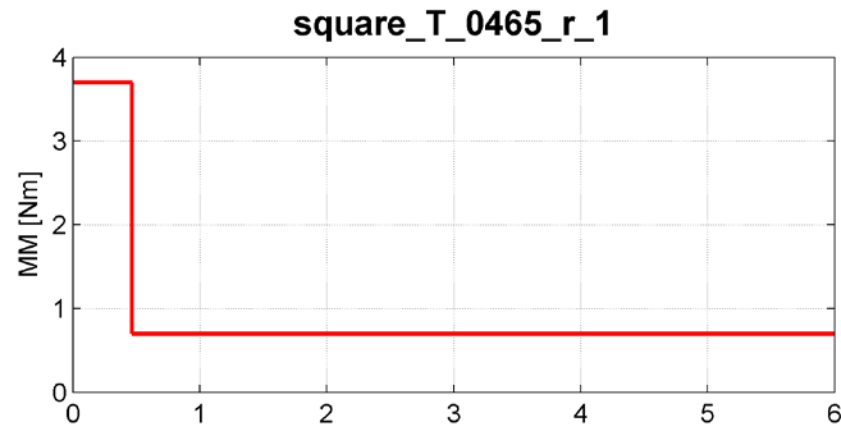
Square Pulse 0.465 s

Excitation: Square pulse of length 0.465 s and height 3 Nm over an offset of 0.7 Nm (total height 3.7 Nm)

Sample Time: 0.003 s

Files:

- square_T_0465_r_1



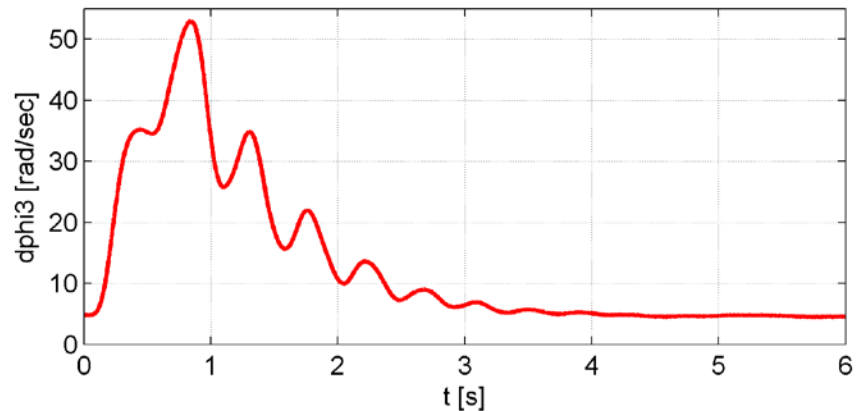
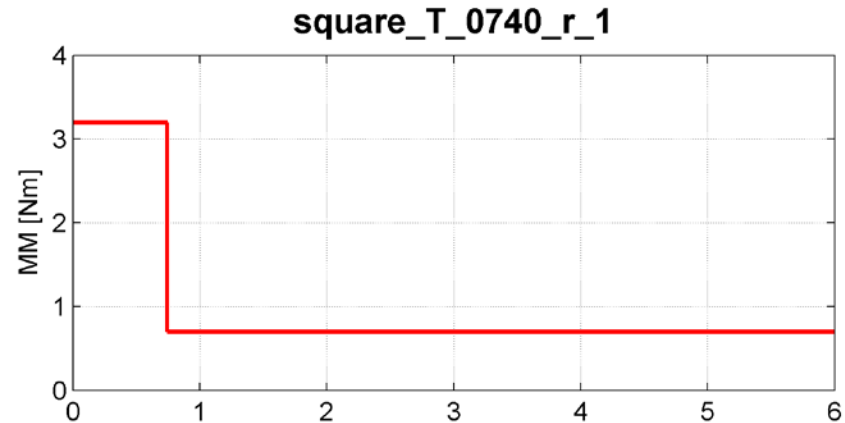
Square Pulse 0.740 s

Excitation: Square pulse of length 0.740 s and height 2.5 Nm over an offset of 0.7 Nm (total height 3.2 Nm)

Sample Time: 0.003 s

Files:

- square_T_0740_r_1



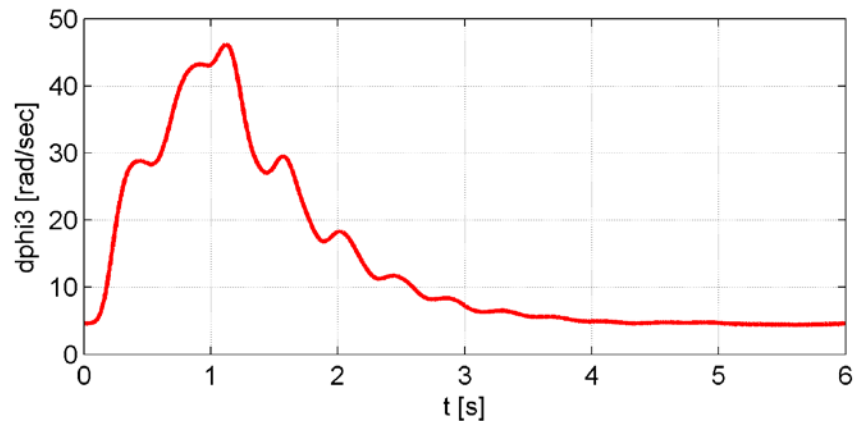
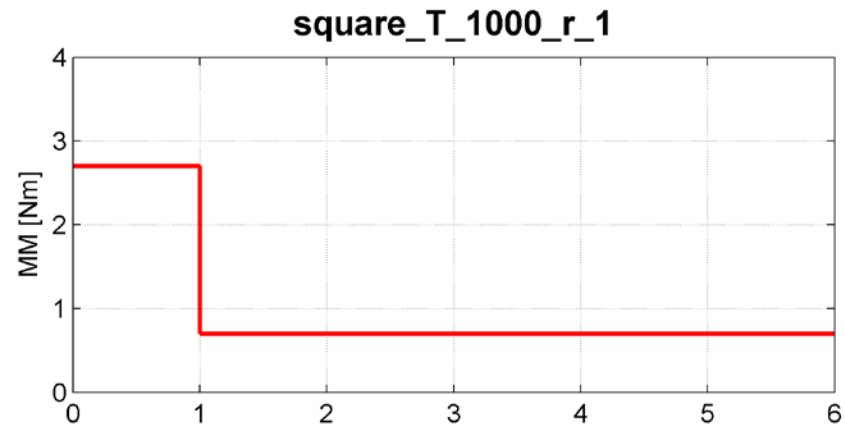
Square Pulse 1.000 s

Excitation: Square pulse of length 1.000 s and height 2 Nm over an offset of 0.7 Nm (total height 2.7 Nm)

Sample Time: 0.003 s

Files:

- square_T_1000_r_1



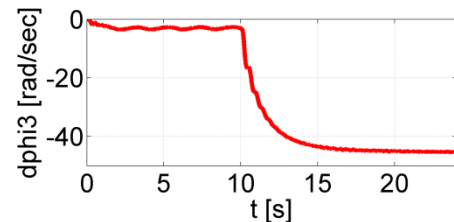
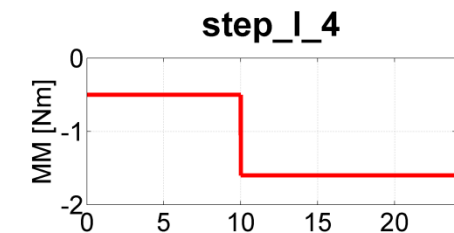
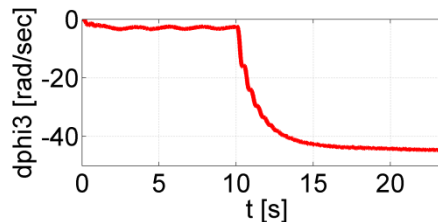
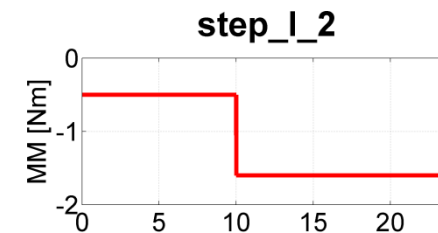
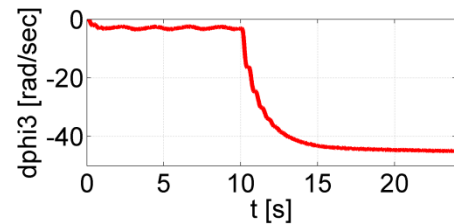
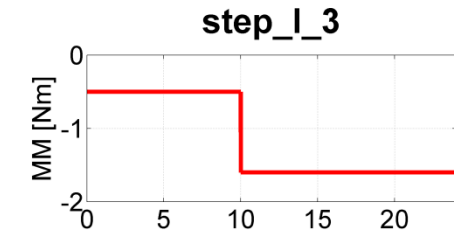
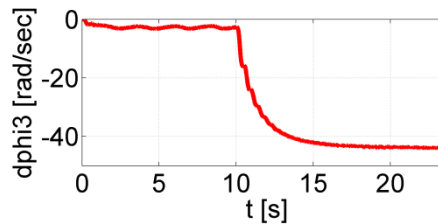
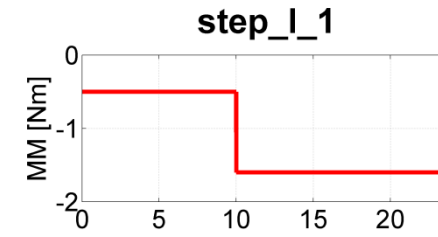
Negative Step (1/2)

Excitation: Negative step at time $t=10$ s and height -1.1 Nm over an offset of -0.5 Nm (total height -1.6 Nm)

Sample Time: 0.003 s

Files:

- step_l_1
- step_l_2
- step_l_3
- step_l_4



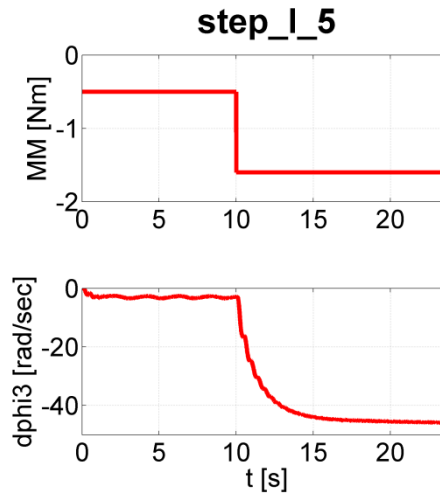
Negative Step (2/2)

Excitation: Negative step at time $t=10$ s and height -1.1 Nm over an offset of -0.5 Nm (total height -1.6 Nm)

Sample Time: 0.003 s

Files:

- step_1_5



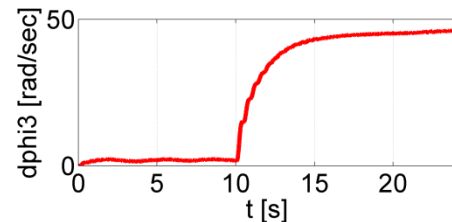
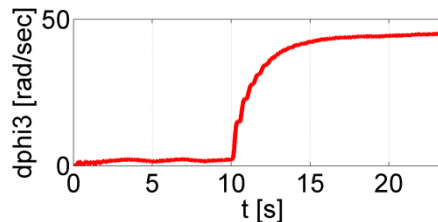
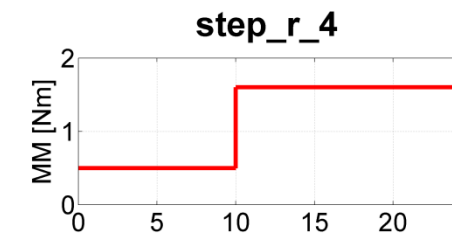
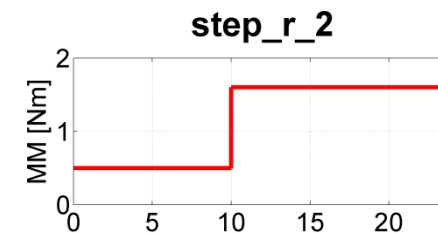
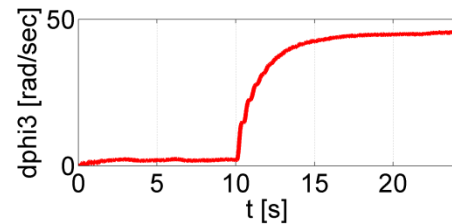
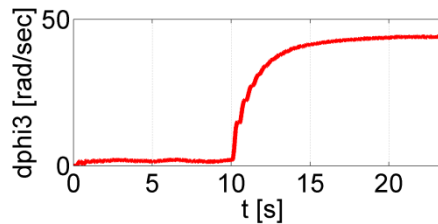
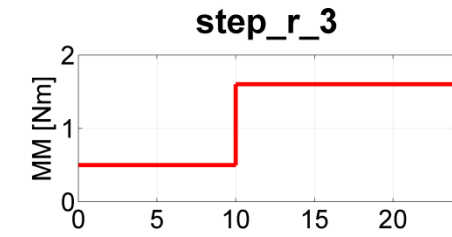
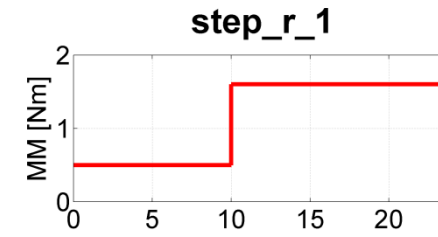
Step (1/2)

Excitation: Negative step at time $t=10$ s and height 1.1 Nm over an offset of 0.5 Nm (total height 1.6 Nm)

Sample Time: 0.003 s

Files:

- step_r_1
- step_r_2
- step_r_3
- step_r_4



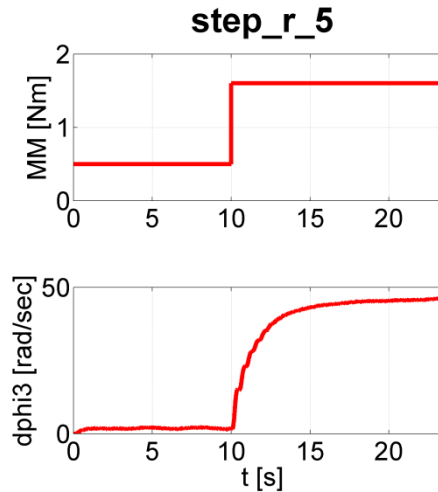
Step (2/2)

Excitation: Step at time $t=10$ s and height 1.1 Nm over an offset of 0.5 Nm

Sample Time: 0.003 s

Files:

- step_r_5



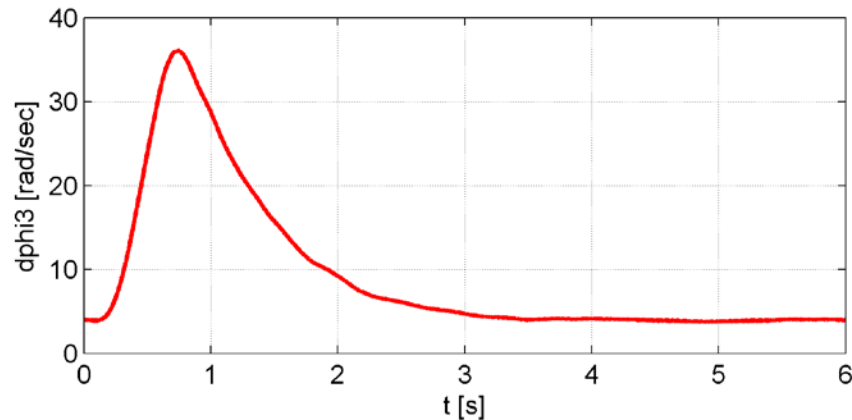
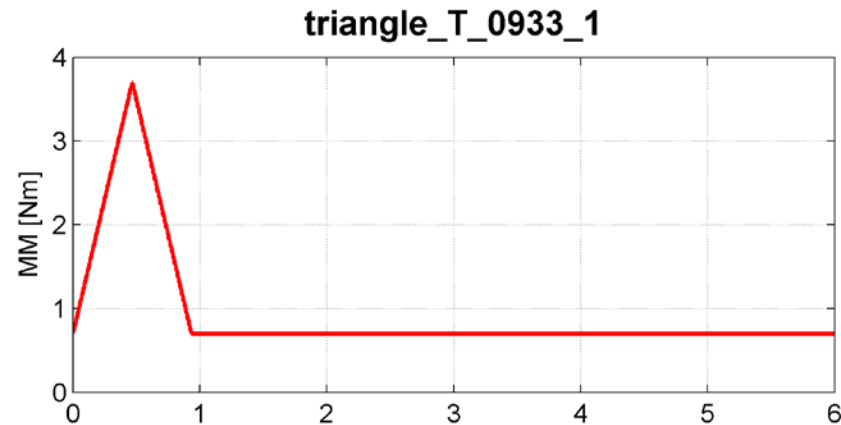
Triangle 0.933s

Excitation: Triangular pulse of length 0.933 s and height 3 Nm over an offset of 0.7 Nm (total height 3.7 Nm)

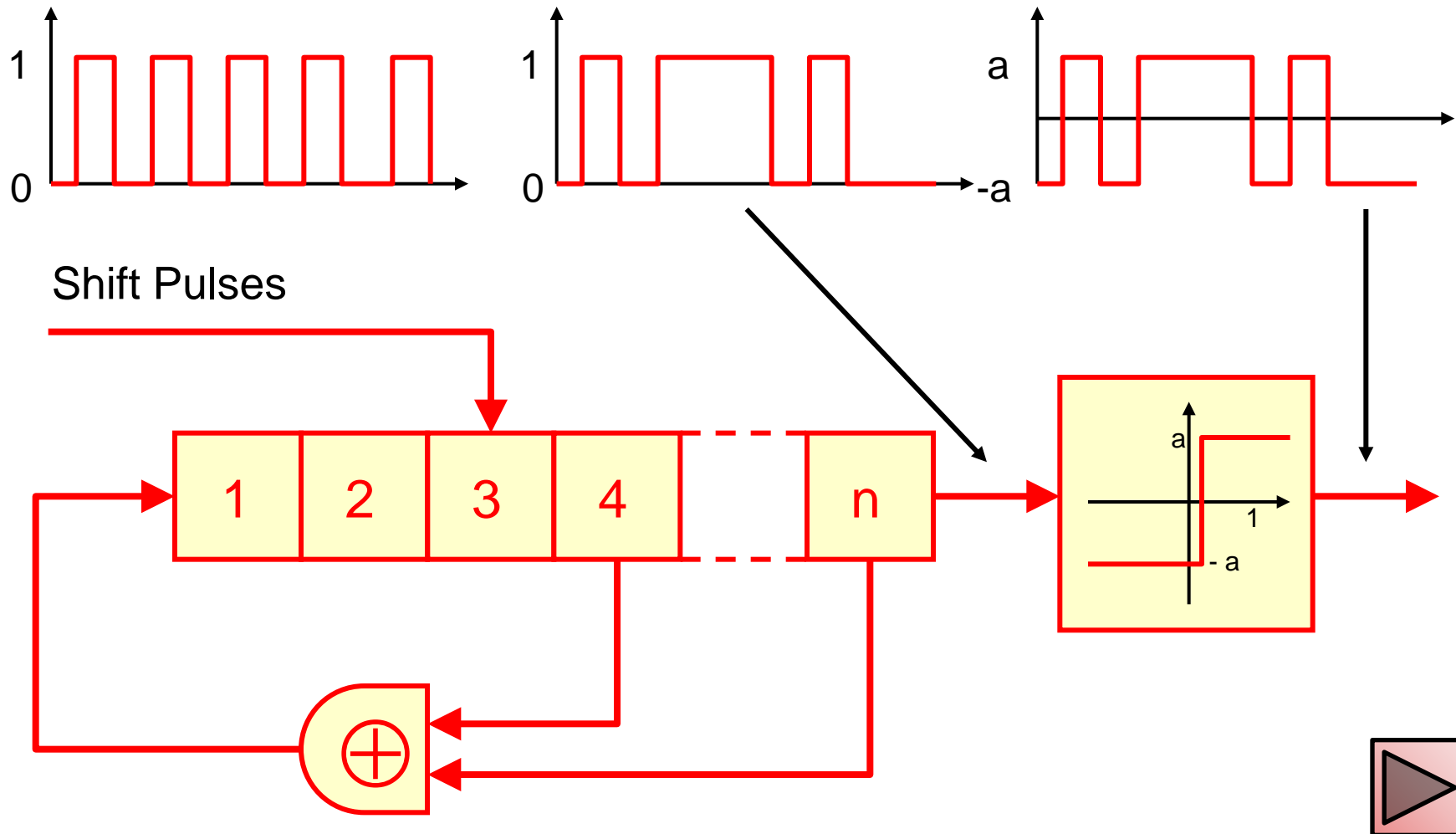
Sample Time: 0.003 s

Files:

- triangle_T_0933_1



PRBS Signals



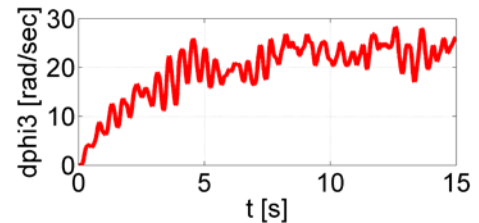
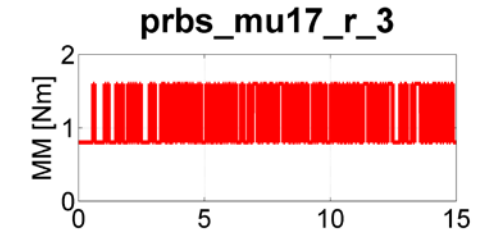
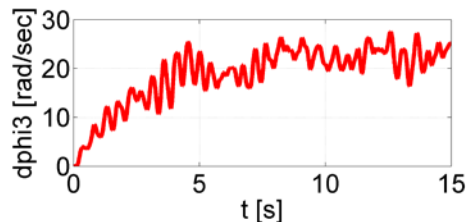
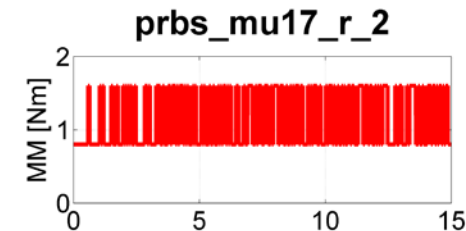
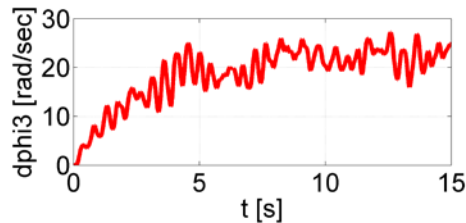
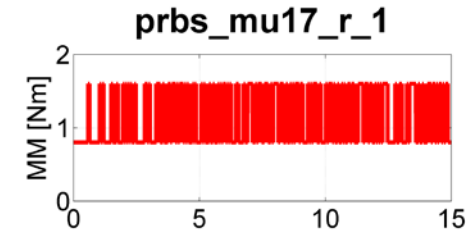
PRBS with $\mu=17$

Excitation: PRBS with $\mu=17$
and values 0.8 Nm and 1.6 Nm

Sample Time: 0.003 s

Files:

- prbs_mu17_r_1
- prbs_mu17_r_2
- prbs_mu17_r_3



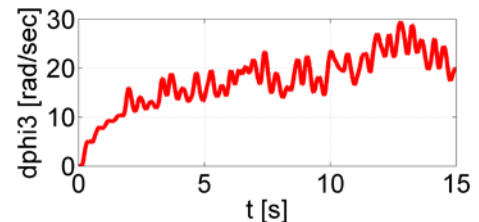
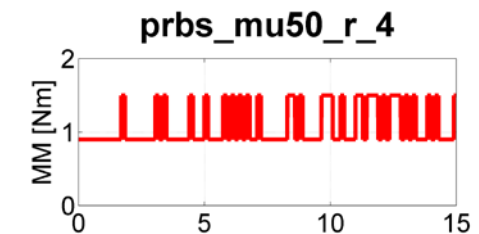
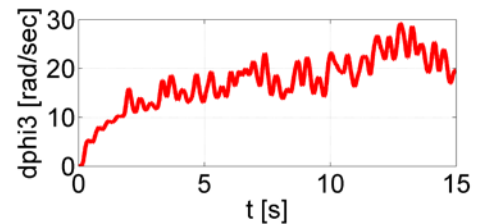
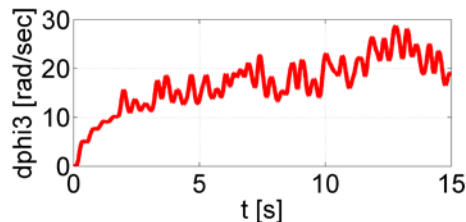
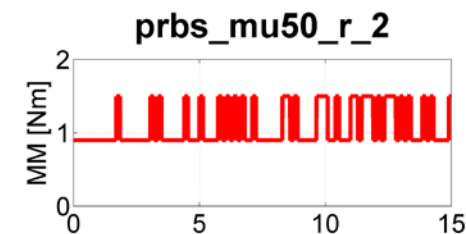
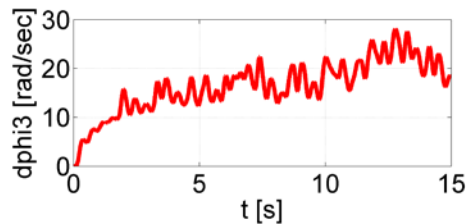
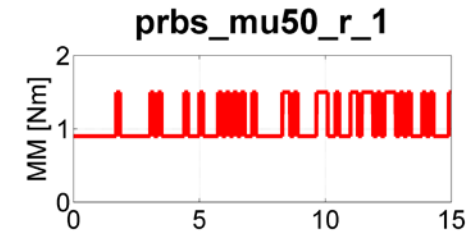
PRBS with $\mu=50$ (1/2)

Excitation: PRBS with $\mu=50$
and values 0.8 Nm and 1.6 Nm

Sample Time: 0.003 s

Files:

- prbs_mu50_r_1
- prbs_mu50_r_2
- prbs_mu50_r_3
- prbs_mu50_r_4



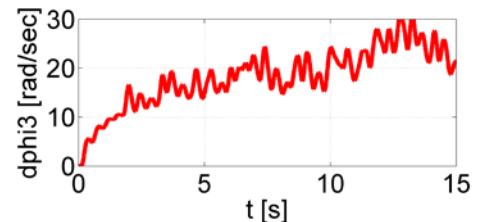
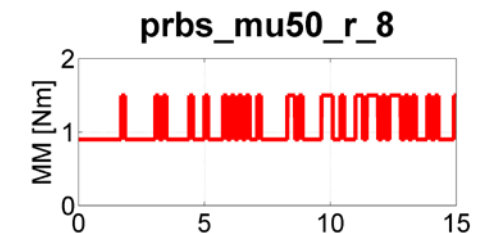
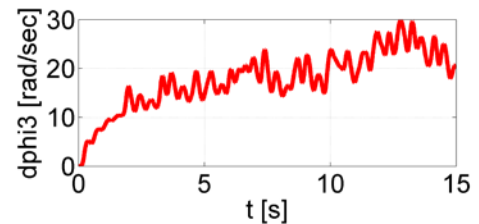
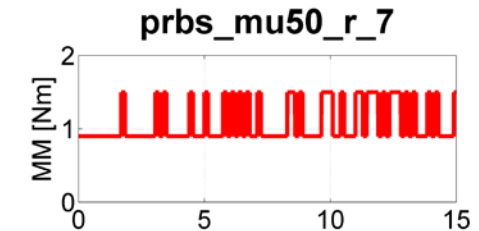
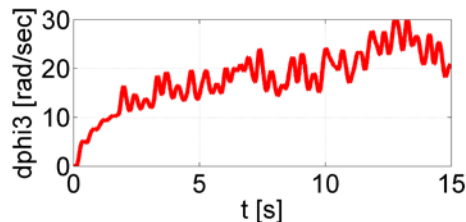
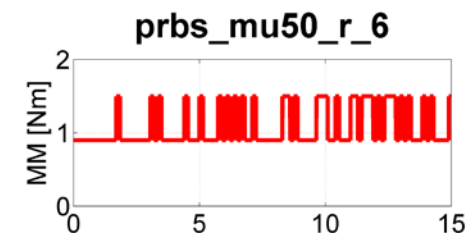
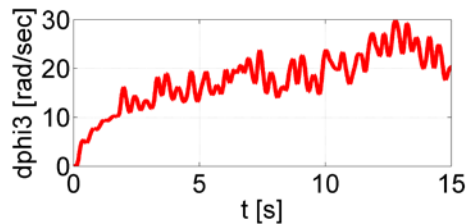
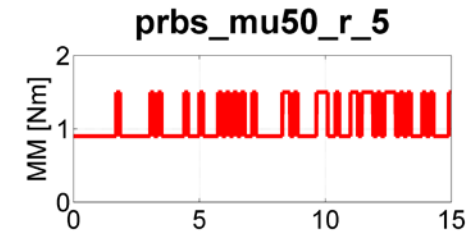
PRBS with $\mu=50$ (2/2)

Excitation: PRBS with $\mu=50$
and values 0.8 Nm and 1.6 Nm

Sample Time: 0.003 s

Files:

- prbs_mu50_r_5
- prbs_mu50_r_6
- prbs_mu50_r_7
- prbs_mu50_r_8



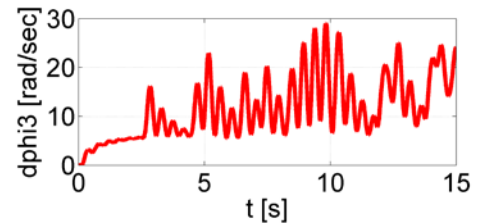
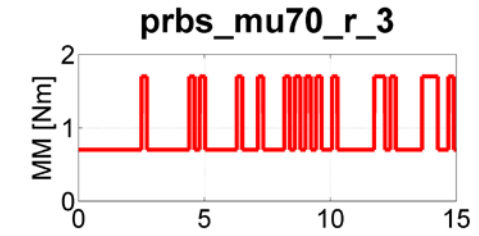
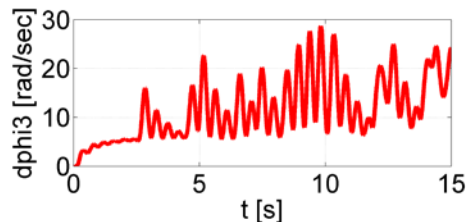
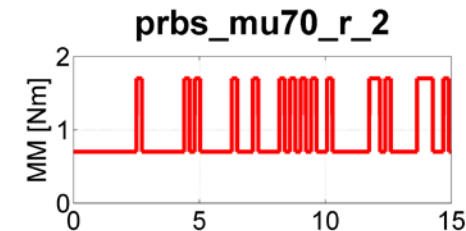
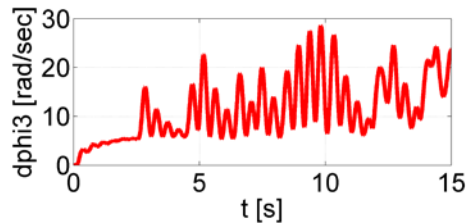
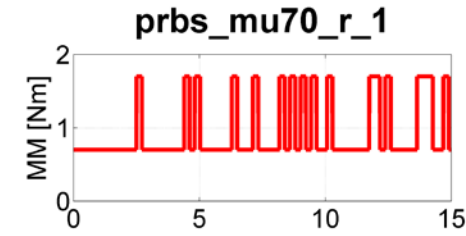
PRBS with $\mu=70$

Excitation: PRBS with $\mu=70$
and values 0.8 Nm and 1.6 Nm

Sample Time: 0.003 s

Files:

- prbs_mu70_r_1
- prbs_mu70_r_2
- prbs_mu70_r_3



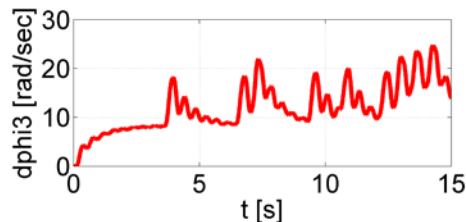
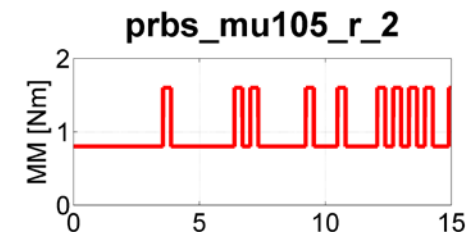
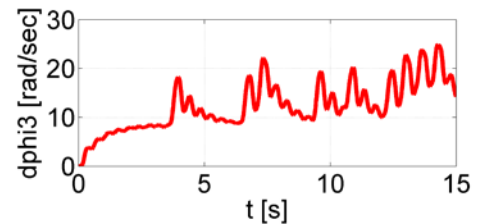
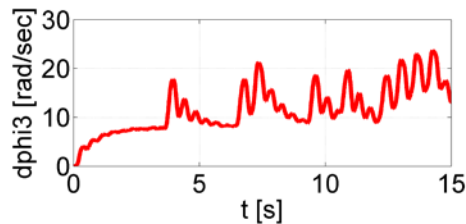
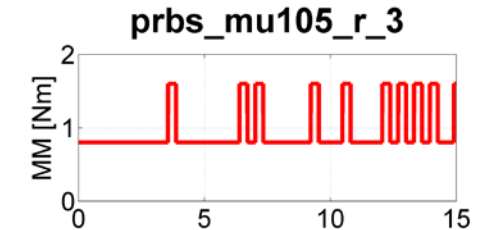
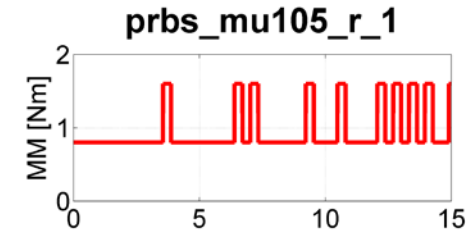
PRBS with $\mu=105$

Excitation: PRBS with $\mu=105$
and values 0.8 Nm and 1.6 Nm

Sample Time: 0.003 s

Files:

- prbs_mu105_r_1
- prbs_mu105_r_2
- prbs_mu105_r_3



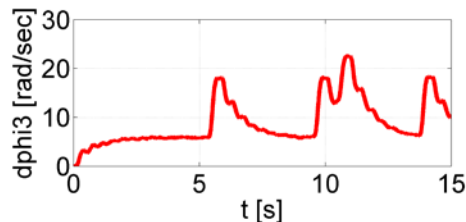
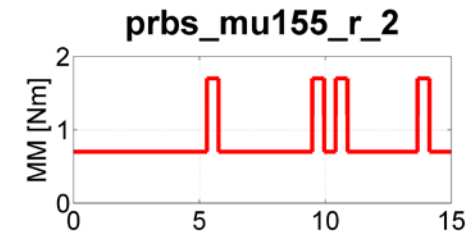
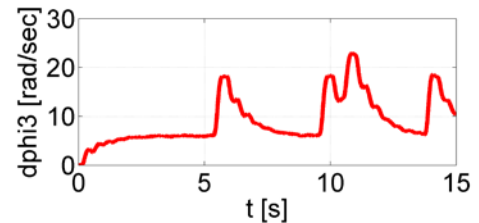
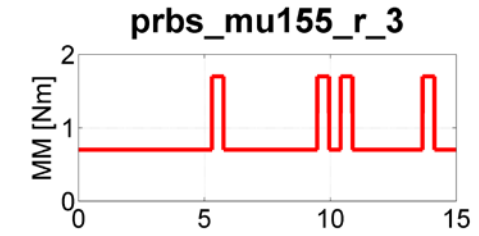
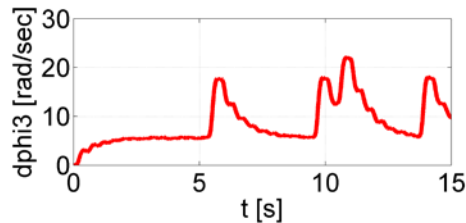
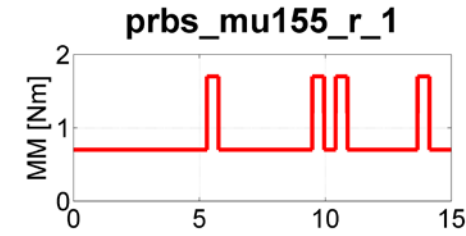
PRBS with $\mu=155$

Excitation: PRBS with $\mu=155$
and values 0.8 Nm and 1.6 Nm

Sample Time: 0.003 s

Files:

- prbs_mu155_r_1
- prbs_mu155_r_2
- prbs_mu155_r_3



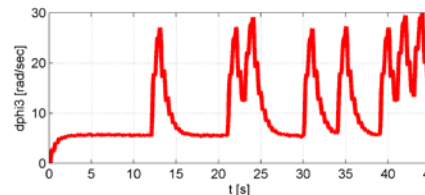
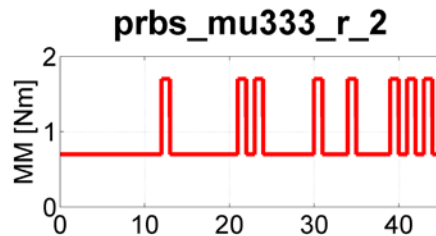
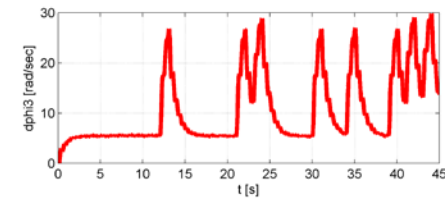
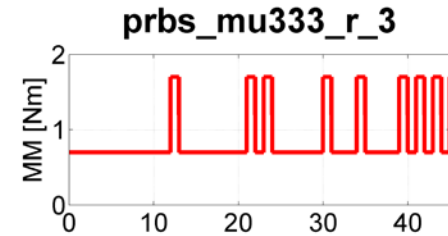
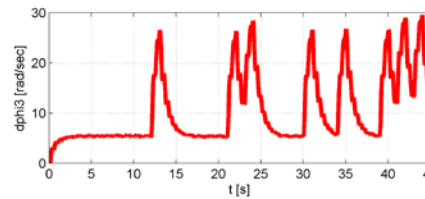
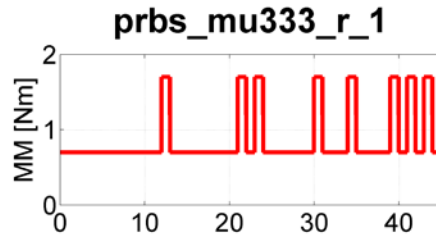
PRBS with $\mu=333$

Excitation: PRBS with $\mu=333$
and values 0.8 Nm and 1.6
Nm

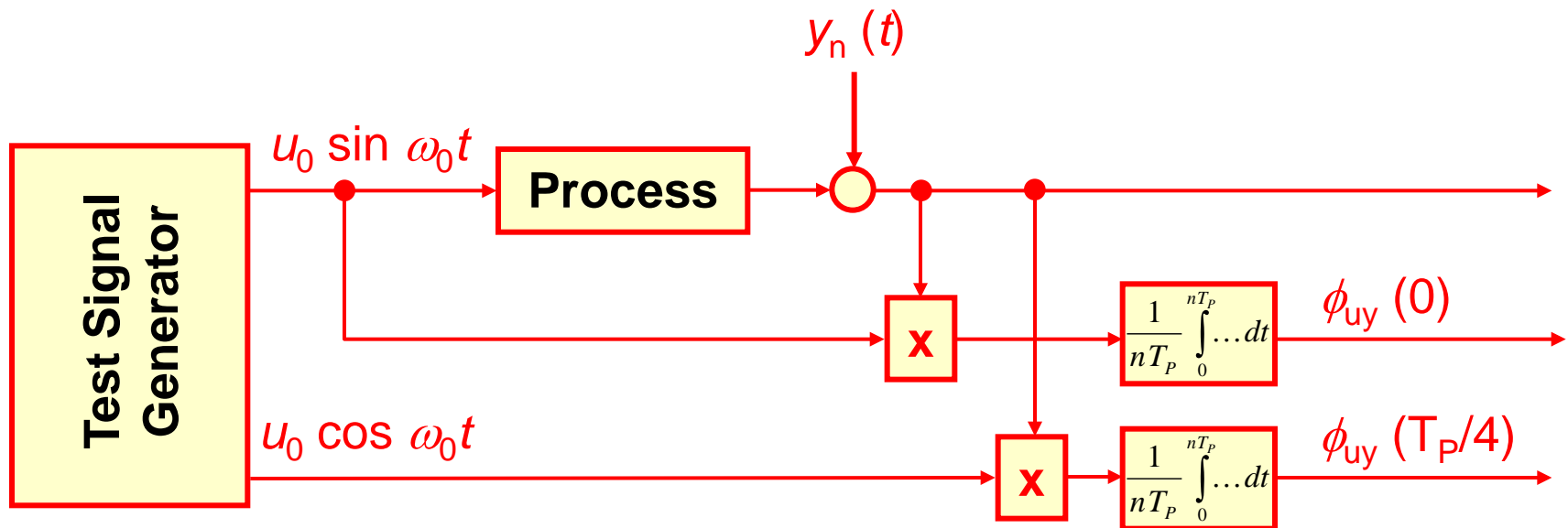
Sample Time: 0.003 s

Files:

- prbs_mu333_r_1
- prbs_mu333_r_2
- prbs_mu333_r_3



Periodic Signals



File Structure

Variable	Name	Unit
ω	w	rad/sec
Amplitude	amplitude_osc	rad/s Nm
Phase	phase_osc	rad



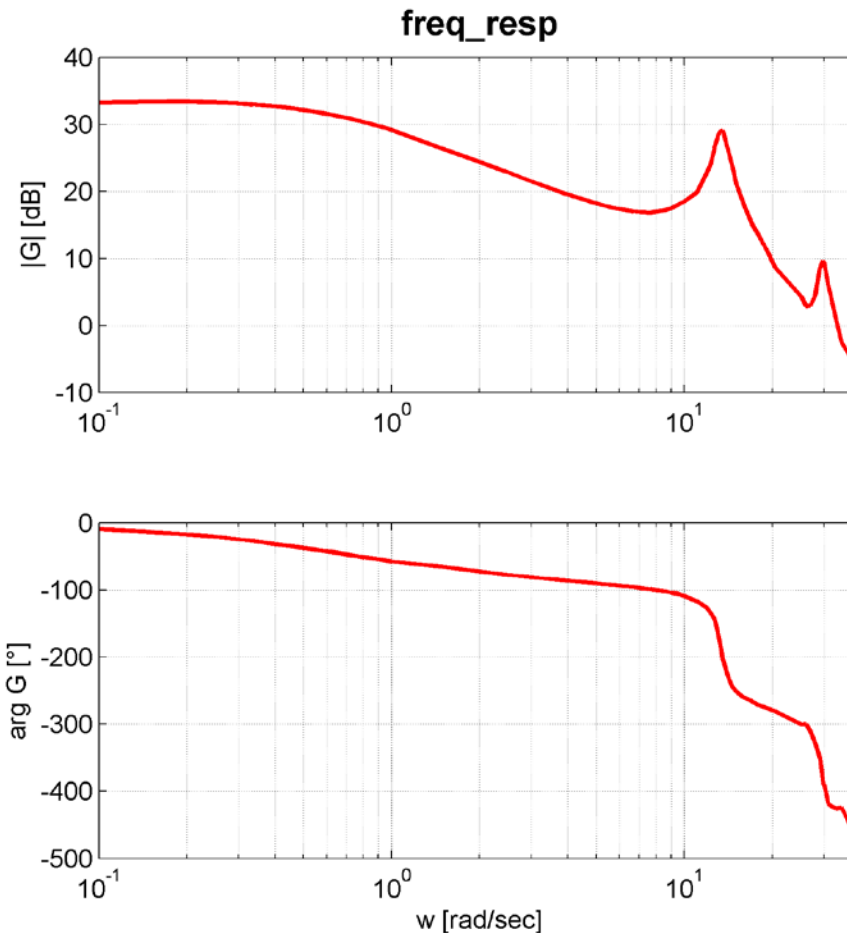
Frequency Response Measured with Orthogonal Correlation

Excitation: Sinusoidal excitation and evaluation with the orthogonal correlation

Data Points: 68 data points between 0.1 rad/sec and 40 rad/sec.

Files:

- freq_resp



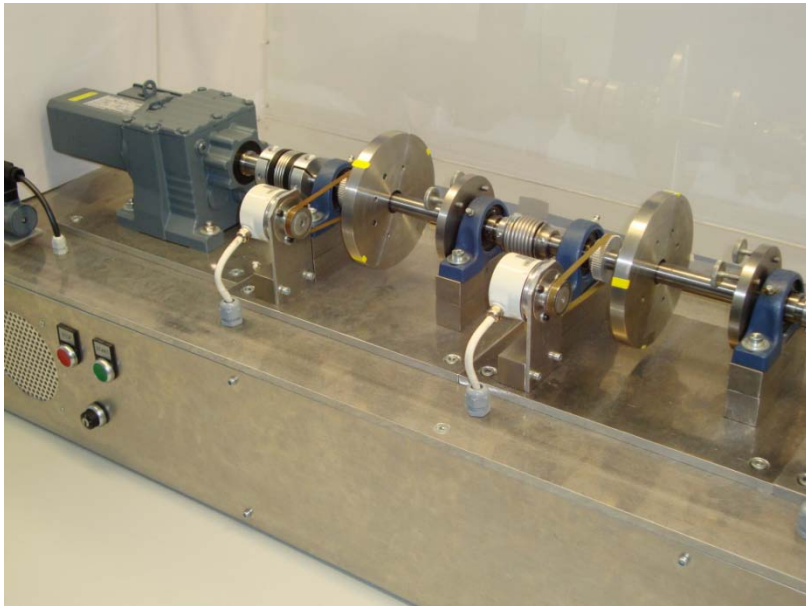
Evaluation with FR-LS for Continuous-Time Model

- Use data set `freq_resp`
- No further pre-processing necessary



Photos of the Three-Mass Oscillator

Detail View



File

three-mass-oscillator-photo1.jpg

Full View



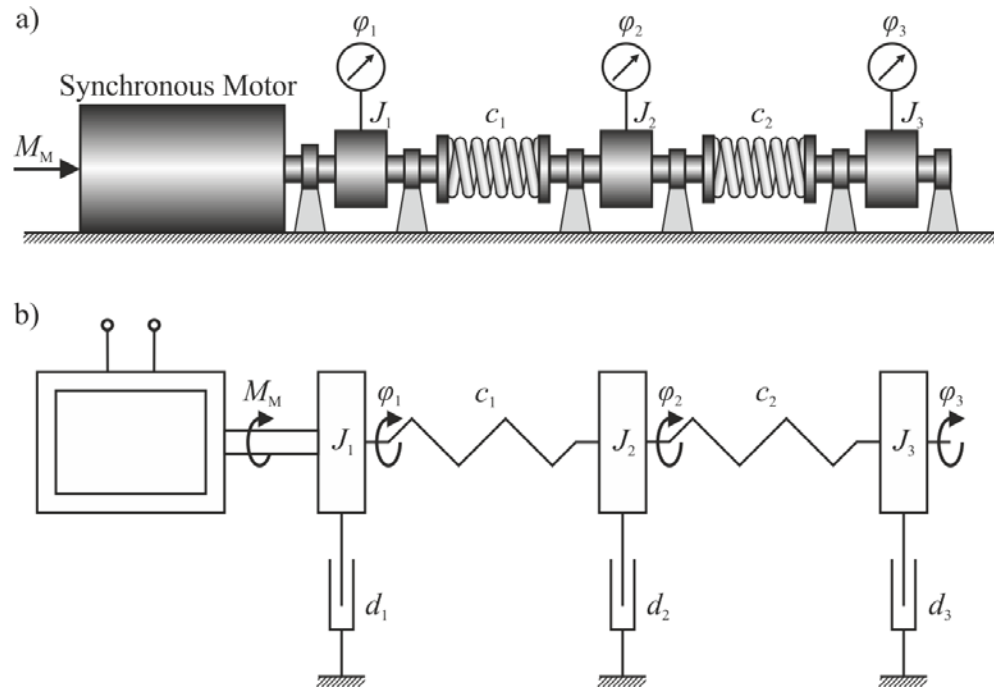
File

three-mass-oscillator-photo2.jpg



Scheme of the Three-Mass Oscillator

Scheme



Files

three-mass-oscillator-scheme.png

three-mass-oscillator-scheme.eps

