Experimental Studies of Signal Digitizing based on Wave Reference Crossings

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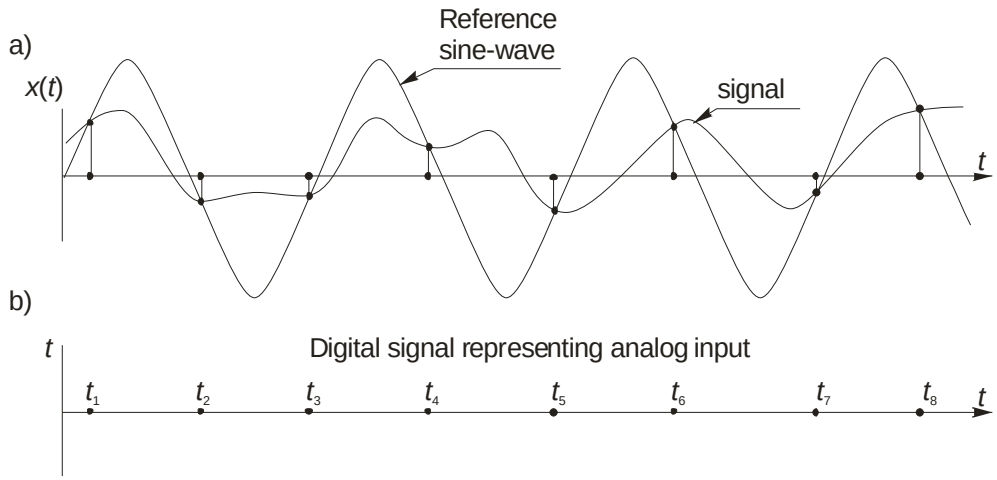
Introduction

Sine Wave Crossing (SWC) based approach to signal digitizing and digital processing is discussed in a number of publications:

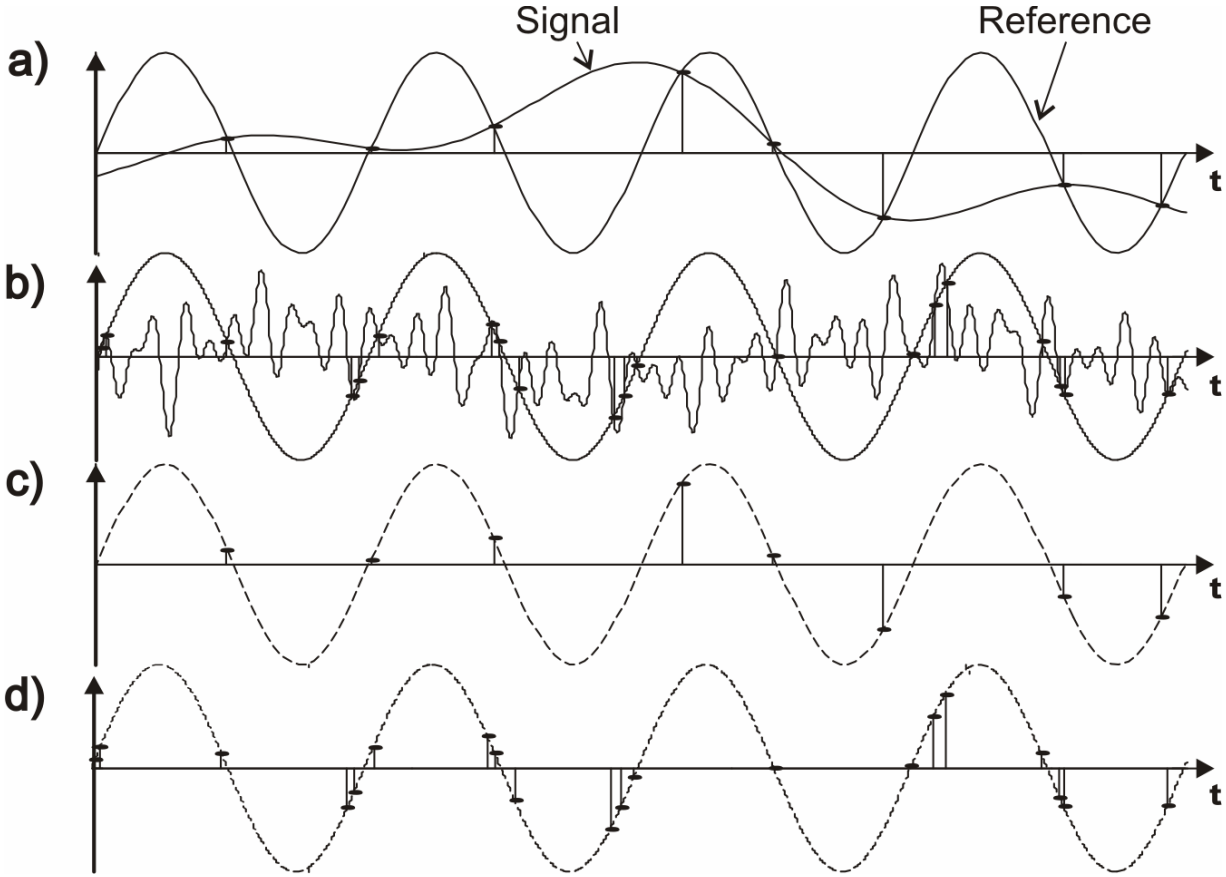
1. I.Bilinskis. Digital Alias-free Signal Processing. Wiley,2007., 430 p.
2. I.Bilinskis, K.Sudars. Digital Representation of Analog Signals by Timed Sequences of Events. “Electronics and Electrical Engineering”, No. 3(83), March, 2008., p. 89-92.
3. I.Bilinskis, K.Sudars. Specifics of Constant Envelope Digital Signals. “Electronics and Electrical Engineering”, No. 4(84), April, 2008., p. 13-16.

- Application of SWC leads to specific digital representation of analog signals.
- Analog signals in this case are converted into discrete time instant sequences.
- Rationality of this approach is based on specific properties of SWC method. It is well suited for data acquisition from a large quantity of signal sources, digital signals obatined in this way can be processed in a complexity-reduced way.

Digital signal representation based on Sine-wave crossings



Constant Envelope digitizing



- Signal Comparators are in the core of Sine Wave Crossing (SWC) based signal digitizing.

- Performance of them determine the quality of systems based on SWC.

- A system has been built for experimental studies of Comparator dynamic behaviour at fulfilling SWC related functions.

- Description of it follows.

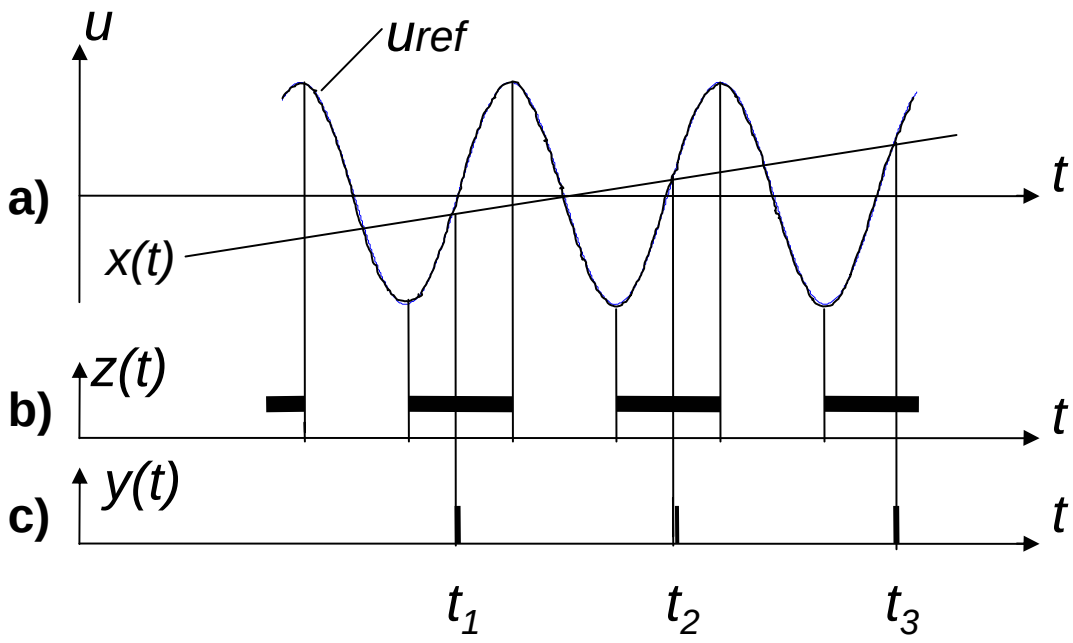


Fig. 1. Output pulses in crosspoints of signals *x(t)* and *Uref*

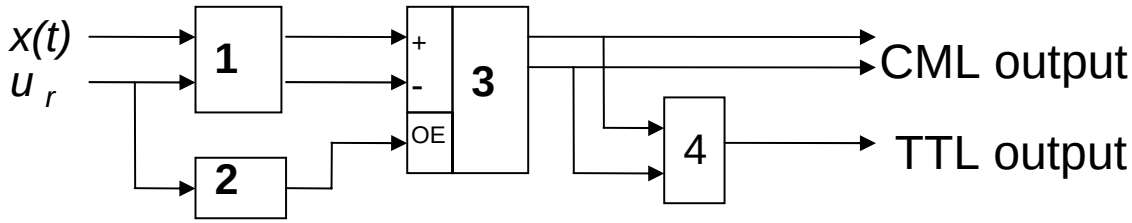


Fig. 2. Basic structure of the investigated SWC digitizer

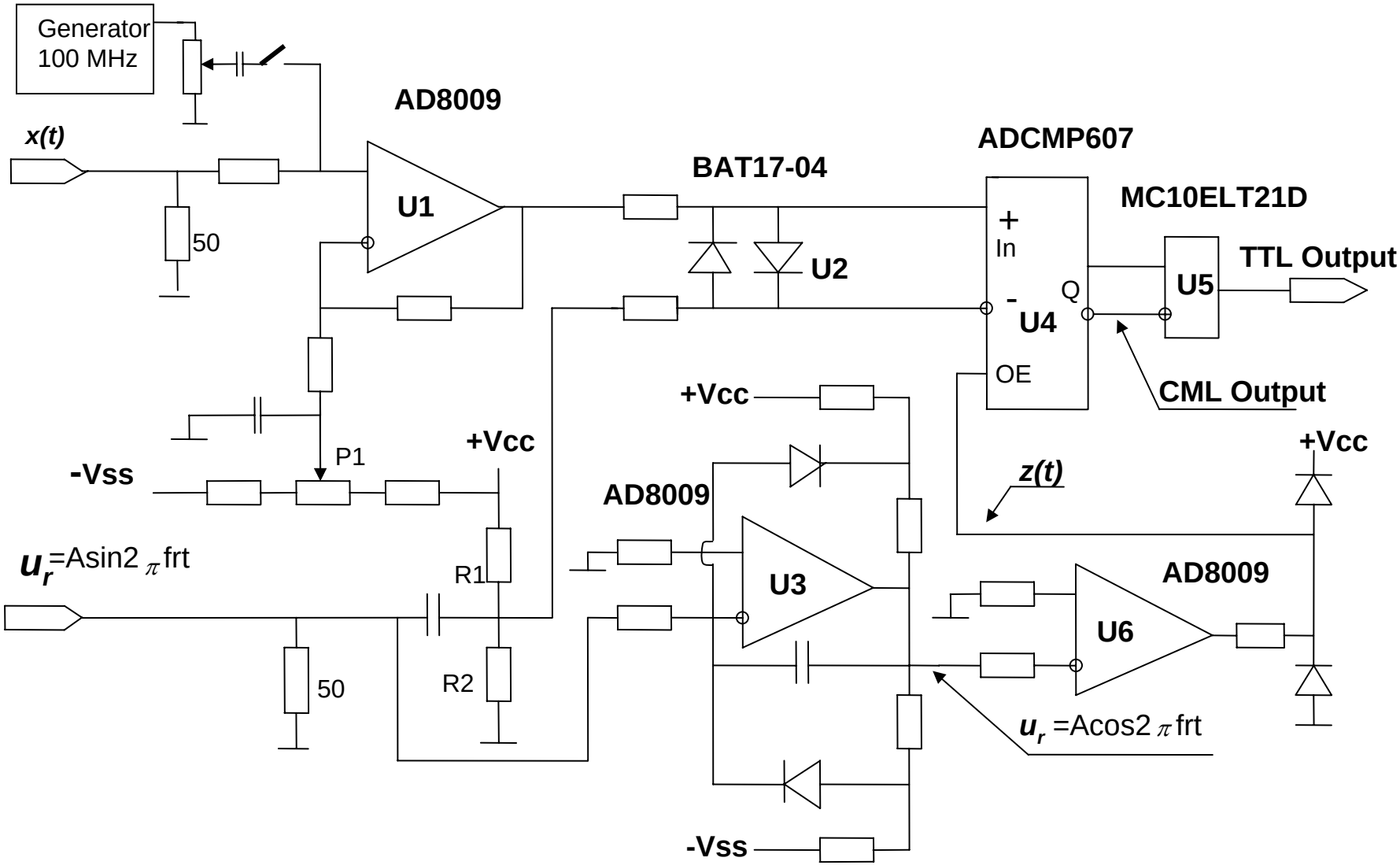


Fig. 3. Shematic diagram of the investigated SWC digitizer

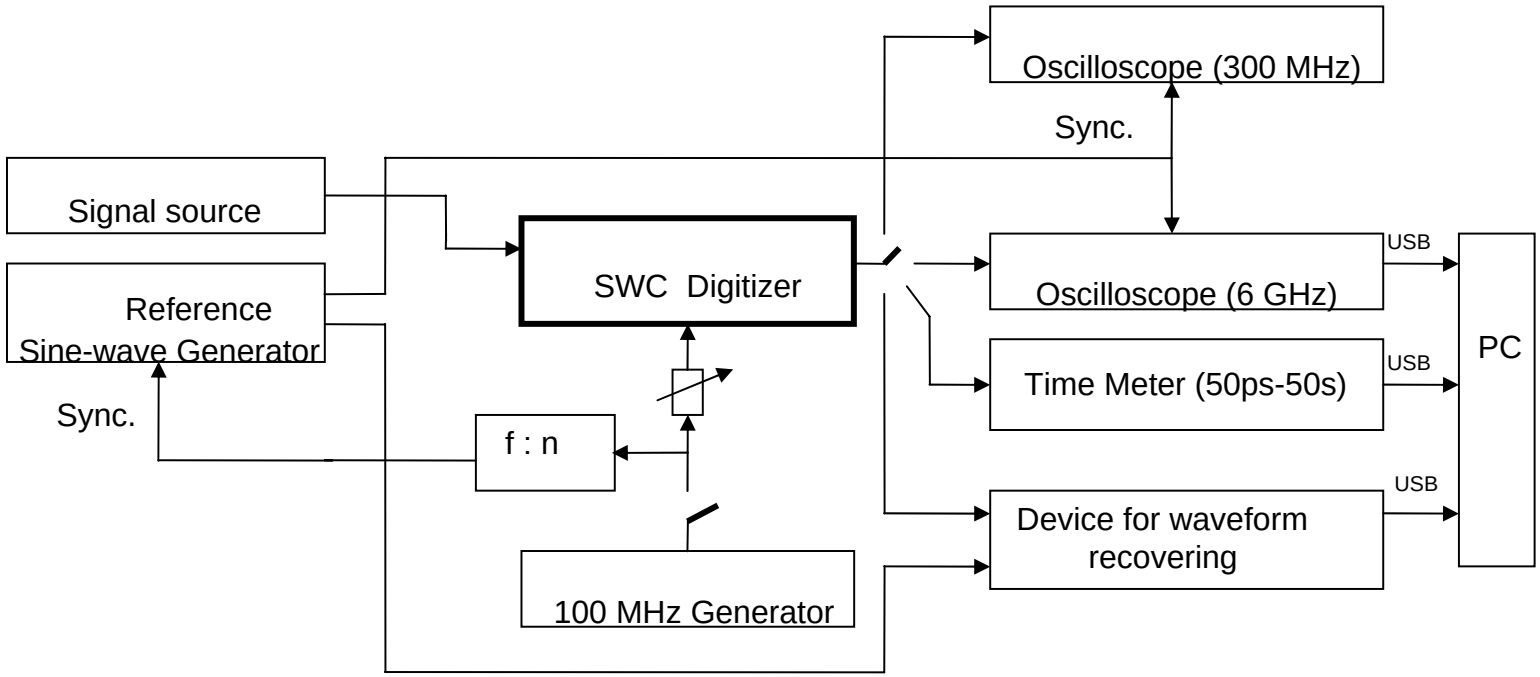


Fig. 4. Structure of the system built for experimental investigation of SWC digitizing

Reference level, mV	20,54	120,87	220,20	421,70
Estimated time intervals, nsec	25,54 25,45 24,78 24,31 24,50 24,58 25,33 25,29 25,16 24,86	78,26 77,91 78,41 77,03 77,93 77,39 77,79 77,22 78,25 77,56	120,85 120,39 120,96 120,53 120,59 120,79 120,29 120,10 120,39 120,22	206,21 206,11 205,79 206,09 205,97 205,54 205,94 205,86 205,31 205,72
Average value, nsec	24,98	77,77	120,51	205,85
Variation, %	$\pm$ 2,46	$\pm$ 0,89	$\pm$ 0,36	$\pm$ 0,22

Table 1. Variation of crossing point estimates.

Reference signal parameters: f_{ref} = 1,000000 MHz; $U_{ref\ pp}$ = 520 mV

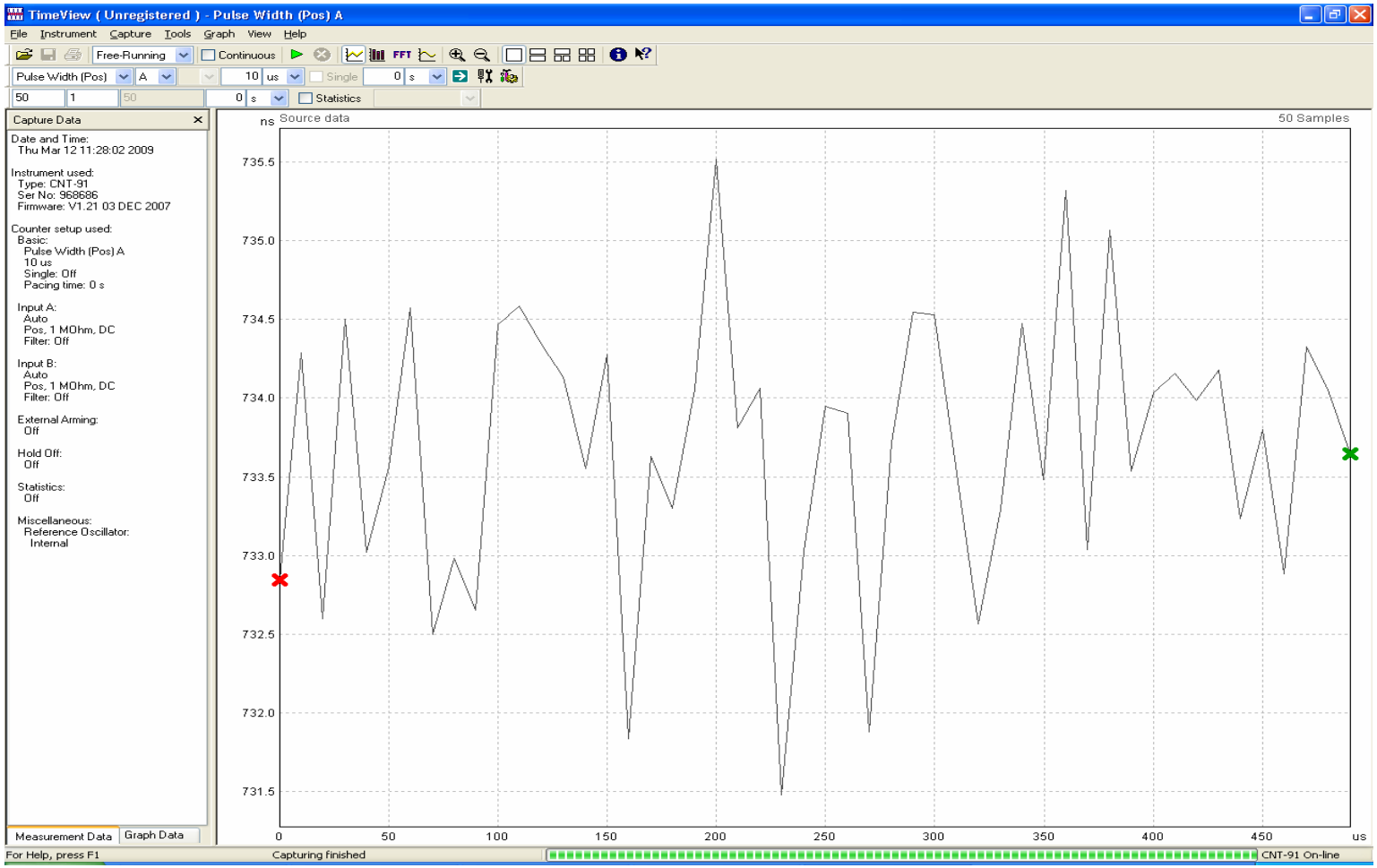


Fig. 5. Fluctuations of the detected crossing point instants under the specific test conditions

a)

b)

c)

Fig. 7. Crosspoint of modulated input signal x(t) and reference signal u_r

Conclusions

- The discussed experimental set-up has been developed, made and tested.

- It is flexibly adaptable to varying digitizing conditions so that it covers the needs of the planned experimental investigations of the signal digitizers based on SWC.