Simulation of a Parametric Oscillator Circuit, Part 2

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Abstract

Parametric oscillator circuits are investigated further in addition to part 1 of this series of papers, where was shown by simulation that energy from spacetime is possible in certain cases. A variable capacitance can give rise to ever increasing oscillations. The design of part 1 is improved so that the circuit is fully self-oscillating and the parametric element is switched by phase conditions only, not requiring an external tuned oscillator. Realization examples (a switched capacitor design and a design by capacity diodes, varicaps) are investigated by simulation and real circuits. The varicap example shows some similarity to the desired behaviour but does not lead to a permanently increasing amplitude. Further design improvements towards "energy from spacetime" are discussed.

Keywords: resonance, electrical circuit, damped resonance circuit, parametric oscillator circuit, electrodynamics simulation, Modelica, LTSpice

1 Introduction

Electrical Resonance circuits are widely used in electrical engineering. Their behaviour is described by the standard laws of electromgnetism that are derived from Maxwell's equtions, for example Lenz' law and Kirchoff's laws. In these circuits energy is conserved. Thermal losses by the Ohmic resistor have to be compensated by energy from an external source like a driving voltage or current, otherwise the oscillation comes to an end. These resonance circuits are described by linear differential equations which can be solved analytically so that their behaviour can be explained quite satisfactorily.

Another method, instead of using a drive voltage or current, is the use of special devices whose technical parameters are changeable by applied voltage or current. A resonance circuit excited by this way is called a parametric oscillator. The AIAS institute found a basic resonance mechanism from spacetime [1] and

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believes that parametric oscillator are a realization of this fundamental mechanism. Due to the non-linearity, the differential equations describing such a circuit take a complicated form, for example coefficients are not constant, making finding of an analytic solution of such equations very difficult. Therefore simulation is an adequate (and even easy) method for solving them. A very extensive work for finding analytical solutions was done by some authors, in particular Osamu [3]- [5]. They were able to define stability regions of the parameters and conditions for energy feeding or release. Such circuits can consume energy as well as produce energy by exponentially falling or rising currents.

The behaviour described in [5] by sophisticated mathematical methods was partly confirmed by our earlier simulations of parametric oscillator circuits [2]. In our earlier work we did not model the physical mechanism how variable devices work. However this is the main problem for constructing a circuit that produces real energy. As was shown in [5] the energy is fed into the circuit by the non-linear elements. When these are modeled together with the circuit, energy is conserved, i.e. the produced energy comes from the non-linear element where it has to be put in to maintain its function. So we can define the fundamental task of this work: Find a non-linear element which works without feedback to the resonance circuit so that its function is independent of the "load" by current or voltage. Such combinations may exist, for example a receiver of electromagnetic radiation in the far field has no effect on the sender. Another example: It is claimed that magnetic moments in a ferromagnet can be switched independently of the volume of the magnet, i.e. the field energy required for flipping the elementary spins into the other direction depends only on the magnetic field strenght, not on the amount of spins to be flipped. On this basis a free energy machine has been proposed [6].

In this paper we introduce a design of a parametric oscillator circuit which is self-oscillating without an external frequency source and therefore requires no frequency tuning. We present two designs with different behaviour and propose how to transduce these into the overunity region.
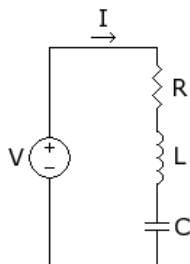
2 Basics of parametric oscillators

Figure 1: Serial oscillator circuit with driving voltage.

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We shortly repeat the basics of resonance in a serial resonant circuit (Fig. 1). This represents a closed current loop consisting of an inductance L, a capacitance C, a resistor R and an AC voltage source U. According to Kirchhoff's law, the sum of the respective component voltages is equal to the driving voltage:

$$U_L + U_R + U_C = U. \tag{1}$$

As known from textbooks or [2], this is a differential equation for a damped forced oscillation

$$L\ddot{Q}(t) + R\dot{Q}(t) + \frac{Q(t)}{C(t)} = U(t) \tag{2}$$

where the dot is the time derivative and Q represents the charge in the capacitor. Throughout this paper we consider a variable capacitance, therefore C in the above equation is time dependent too.

The standard procedure described in [2] and the literature cited therein is to use either a driving voltage or current in the circuit as shown in Fig. 1 with the resonance frequency, or to vary one of the parameters L or C by the doubled resonance frequency. In this second method, the circuit operates as a parametric oscillator. For to start the oscillations, the first method can be applied additionally, but can be switched off after some oscillations.

3 Circuit using switched capacitors

In the first try of realizing the variable capacity we used two capacitors which were switched alternatively in series and in parallel to obtain different effective capacity values. Two changeover switches or four one-way switches are required for this, see Fig. 2.
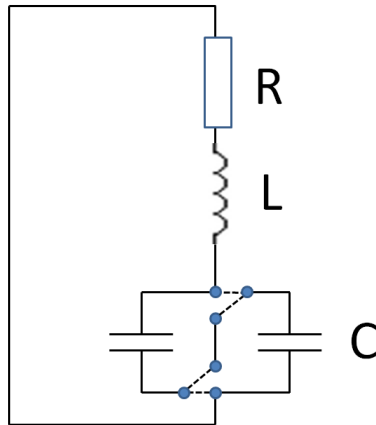

Figure 2: Realization of switched capacity, two capacitors switched in parallel and in series.

The capacity had to be actively switched by a rectangular frequency. This resulted in a nonlinear waveform with increasing amplitude.

For this paper we use the following algorithm for switching the capacity. The actual capacity is determined from the signs of the current and the voltage at the coil:

$$C = \begin{cases} C_2 & \text{if } (U_L \geq 0 \text{ and } I \geq 0) \text{ or } (U_L \leq 0 \text{ and } I \leq 0) \\ C_1 & \text{else} \end{cases} \tag{3}$$

where C_2 is the smaller and C_1 the larger value of the capacitance. This is a phase-controlled operation without any external predefined frequency.

3.1 Simulation of switched capacitors

The simulation was performed by the open source simulation package Open-Modelica [7]. The following parameters were used for the circuit (in SI units):

$$C_1 = 1 \cdot 10^{-8} \text{ F} \tag{4}$$
$$C_2 = 3 \cdot 10^{-9} \text{ F} \tag{5}$$
$$L = 0.001 \text{ H} \tag{6}$$
$$R = 20 \ \Omega \tag{7}$$

In Fig. 3 the time dependence of the current is shown. The amplitude more than doubles per each half-wave. This is the highest increase we have ever observed compared to all simulations in [2]. The phase switching defined in Eq.(3) is highly effective.

How the phase switching works can be seen from Fig. 4. Besides the current I the voltages U_L and U_C are shown as well as the switching function called "p" which switches bewtween high and low capacity values. The meaning of p is inverse, i.e. for high p the capacity is switched to low. During this transition, the voltage at the capacitor increases unsteadily because the same amount of charge has to share a lower capacity. the inductance voltage increases correspondingly in opposite phase. Switching to the high capacity is done where voltages are zero, that means there cannot be a drop of voltage. So the net effect is to enlarge the amplitudes of voltages as well as the current.

This behaviour of the circuit is quite stable. The ratio between capacitance and inductance can be varied in a wide range which was not possible for the constructions discussed in [2]. The ratio between C_1 and C_2 should lie between 5 and 10 in order to give an increase of amplitudes.

The simulation showed that during the switching process high recharge currents arise due to the changed circuit logic. This lets the rising of the oscilaltor current disappear. As explained in the introduction, the excess energy must be delivered from the switching elements which is not the case here. Only some decreasing heterodyne-like oscillations were obtained in the best case as shown Fig. 5.

3.2 Real circuit of switched capacitors

The switched capacities circuit was built by using solid state relays as switches that contain two field effect transistors each, switched against each other. The relays are controlled by a microprocessor.
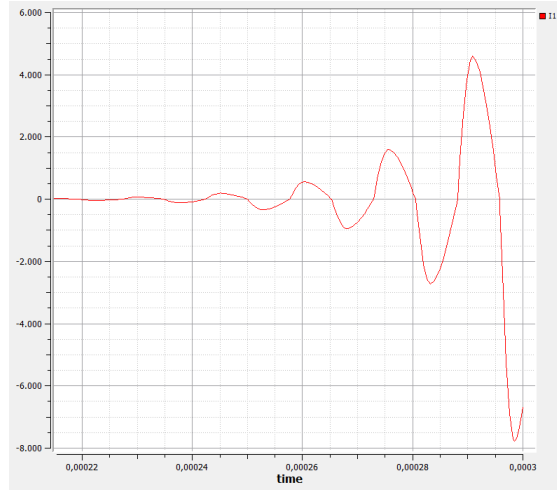
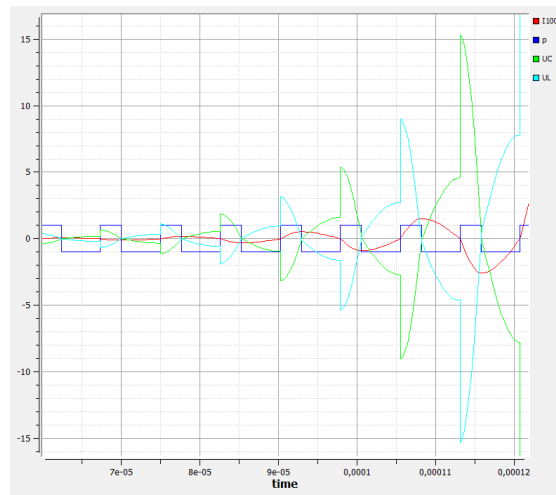Figure 3: Current I of phase-switched parametric resonance circuit.

Figure 4: Current $I * 100$, voltages U_L, U_C and switching function p for phase-switched parametric oscillator.
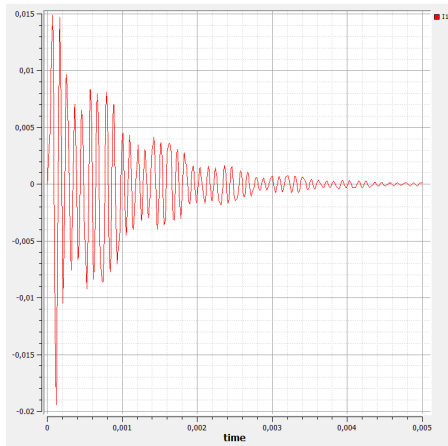
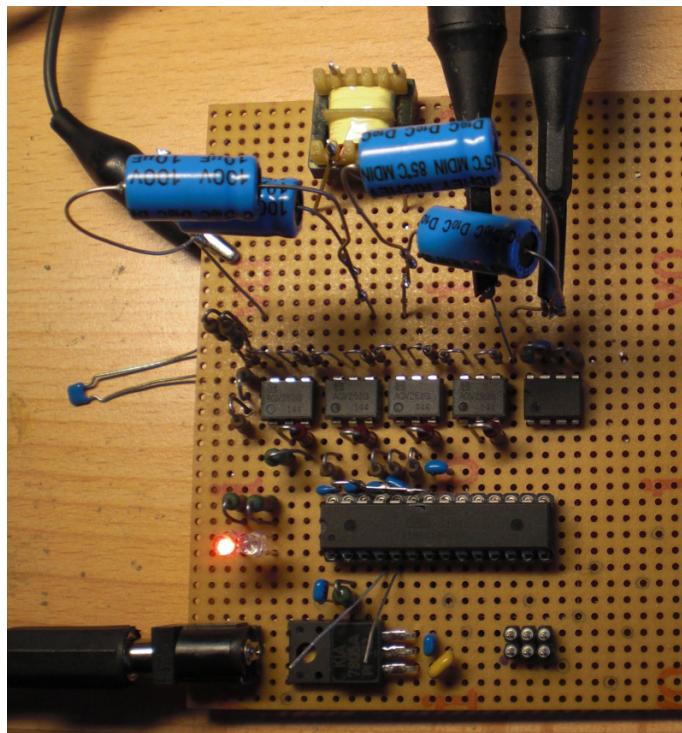Figure 5: Resulting current I for the circuit design of Fig. 2.

Figure 6: Circuit realisation for capacity switching.

Fig. 6 shows the circuit built on a breadboard. The coil can be seen in the uppermost part of the photo, beneath are both capacitors, consisting of two bipolar elcos each, and four relays and a comparator for detecting zero crossings, further down the microprocessor.

Comparison of current and voltage curves with the LTspice [8] simulation gives good agreement of essential properties, in particular the jumps in voltage, marked by A in Fig. 7. In addition, some artifacts are visible, marked by B, arising from the very inert switching behaviour of the relays.
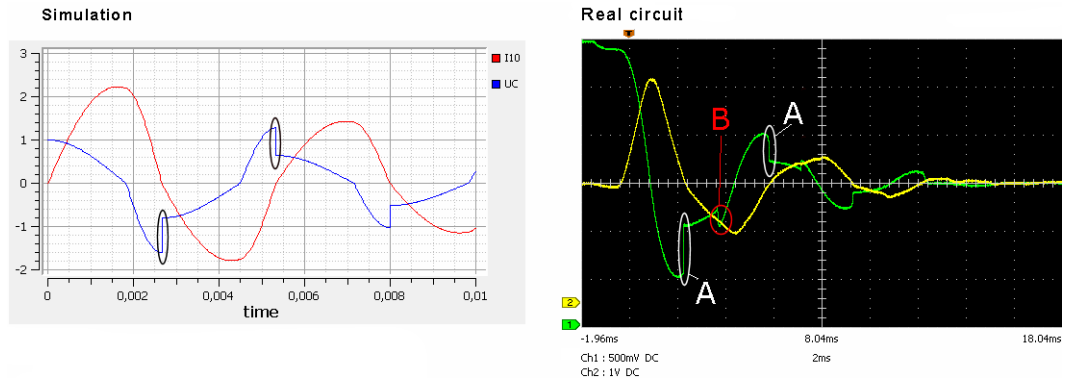

Figure 7: Comparison of simulation with oscilloscope output.

4 Circuit using varicap diodes

For constructing parametric oscillators, a varicap or varactor [9], a special type of diode, is well suited. A diode consists of two conducting regions between which a non-conducting layer develops when a voltage is applied in inverse direction. The conducting regions correspond to the plates of a capacitor, the non-conducting layer to the dielectric between the plates. By applying a varying voltage the thickness of the non-conducting layer is altered and thereby the capacitance of the varactor, in the range of p.e. from 70pF at 1V to 3pF at 28V.

As in the case of the switched capacitors, here we have two possibilities of excitation again, namely by an external oscillator or by self-triggering.

4.1 Circuit using varicap diodes with external frequency

In Fig. 8 the circuit design is shown. The oscillator circuit is constructed symmetrically: the capacitor is built from opposedly switched capacity diodes, the inductor has a contact line in the middle. Thus the voltage being connected to the capacity diodes cannot directly stimulate the oscillator circuit. Five varactors have been switched in parallel in order to keep the switching frequency low enough. The varactors are activated by an AC voltage 'Signal-In'. In addition an offset voltage defines the desired operating range.
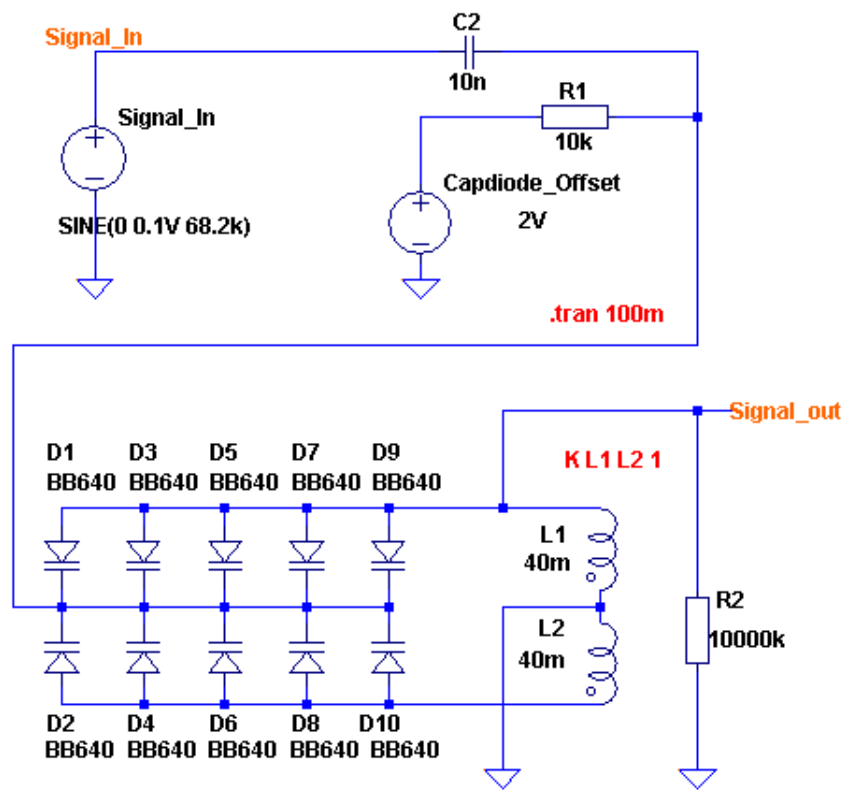
Figure 8: Parametric oscillator with varicaps and external excitation.

4.1.1 Simulation of a varicap circuit with external frequency

The circuit shown in Fig. 8 was simulated by LTspice first. The simulation result is graphed in Fig. 9.

The AC voltage of about 0.1V applied to the diodes is shown by green colour. The oscillation builds up after some time. The voltage in the oscillator circuit (blue colour) rises to about 1V. The amplitude is limited because the capacity diodes are impacted not only by the applied external voltage but also by the voltage in the circuit. Due to the relatively high frequency, only filled areas are visible in the diagram. Therefore a part of the diagram is shown on an expanded scale in Fig. 10.
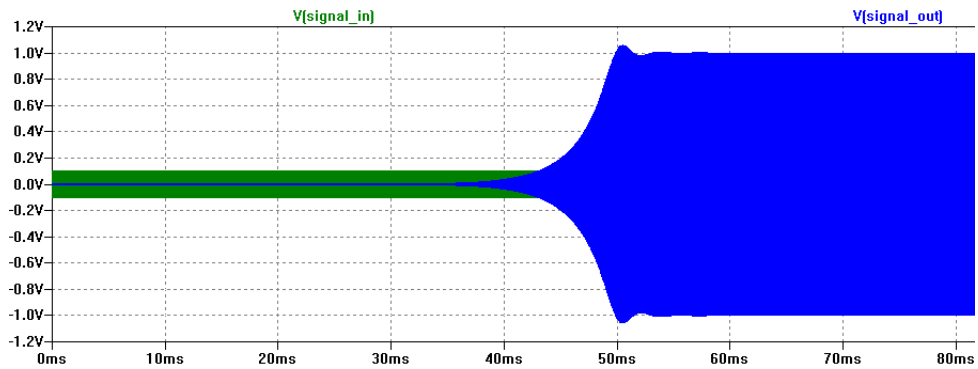
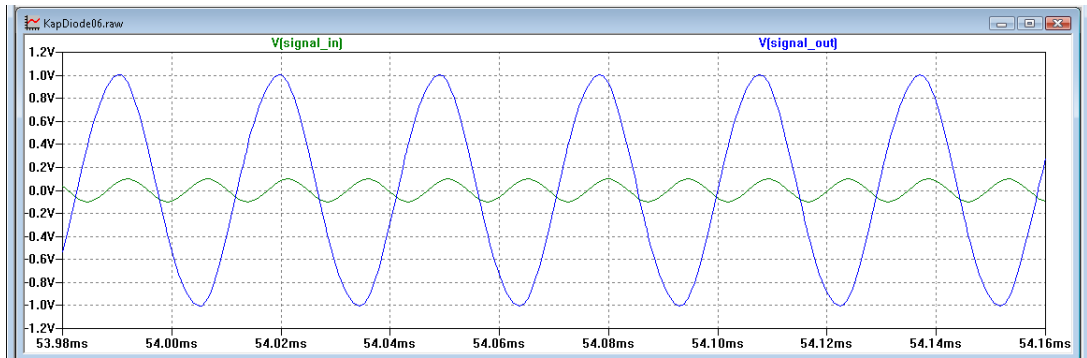Figure 9: Simulation of the parametric oscillator circuit with varicaps.

Figure 10: Zoom into the simulation results of Fig. 9.

4.1.2 Real built varicap circuit

For practical purposes the circuit of Fig. 8 was soldered in an ad-hoc setup. At the left hand side of Fig. 11 the offset voltage (marked by a red arrow) and the input voltage 2f (green arrow) are applied. At the right hand side the output voltage (marked blue) is measured at the inductor.

As can be seen from Fig. 12, the result predicted from the simulation of Fig. 10 is in good agreement with the measurement.
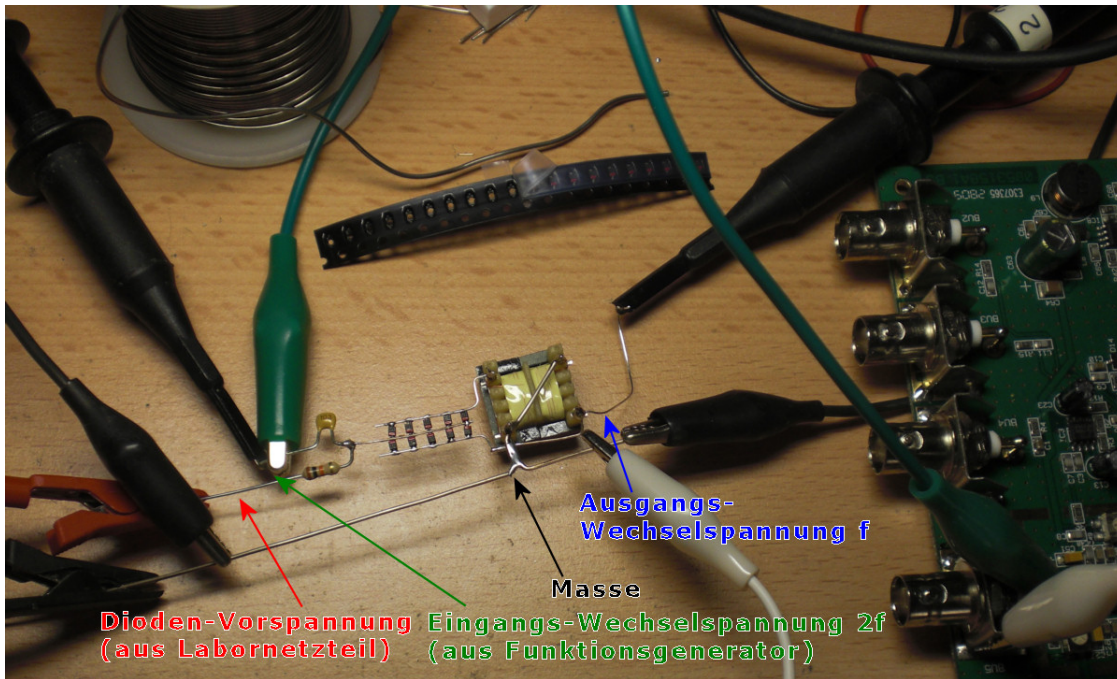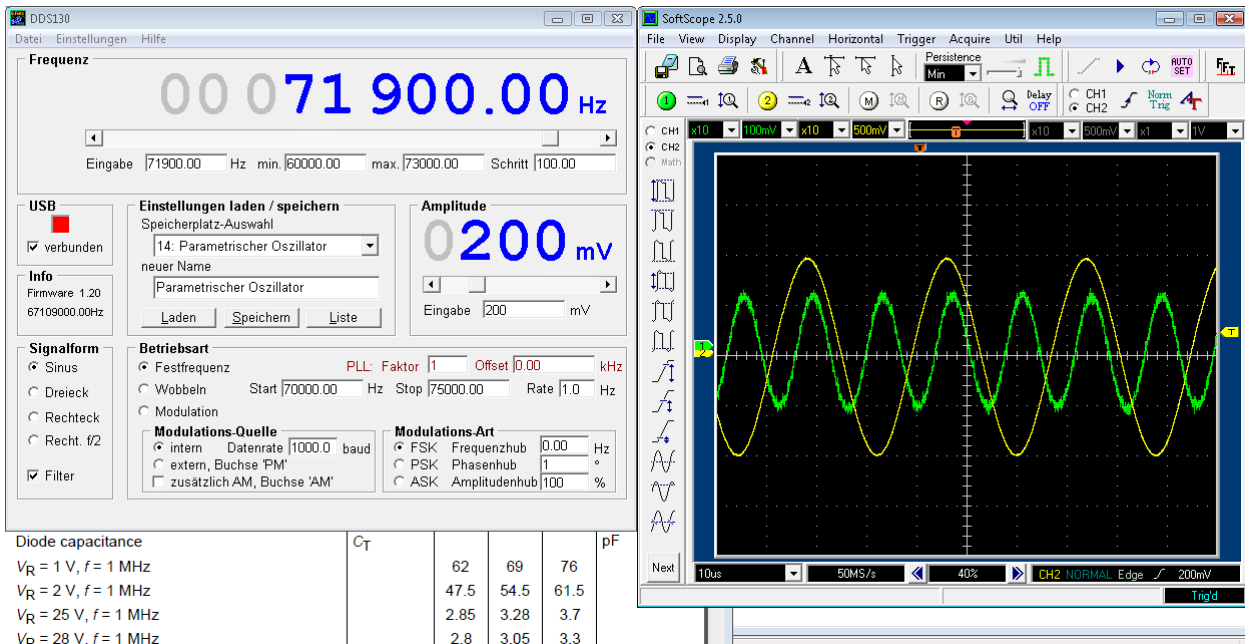
Figure 11: Realization of the varicap circuit.

Diode capacitance	C_T				pF
V_R = 1 V, f = 1 MHz		62	69	76	
V_R = 2 V, f = 1 MHz		47.5	54.5	61.5	
V_R = 25 V, f = 1 MHz		2.85	3.28	3.7	
V_R = 28 V, f = 1 MHz		2.8	3.05	3.3	

Figure 12: Function generator for excitation, oscilloscope view, and a look at the varicap data sheet.

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4.2 Circuit using varicap diodes with auto-trigger

Also for the circuit with varicaps it is possible to use an automatic triggering instead of an externally connected AC voltage. The circuit design, which already requires a certain complexity, is dispayed in Fig. 13.

4.2.1 Simulation of a varicap circuit with auto-trigger

The simulation result graphed in Fig. 14 shows a clear build-up of the oscillation. The jumps in voltage, already seen in preceding simulations (Fig. 4), appear again.
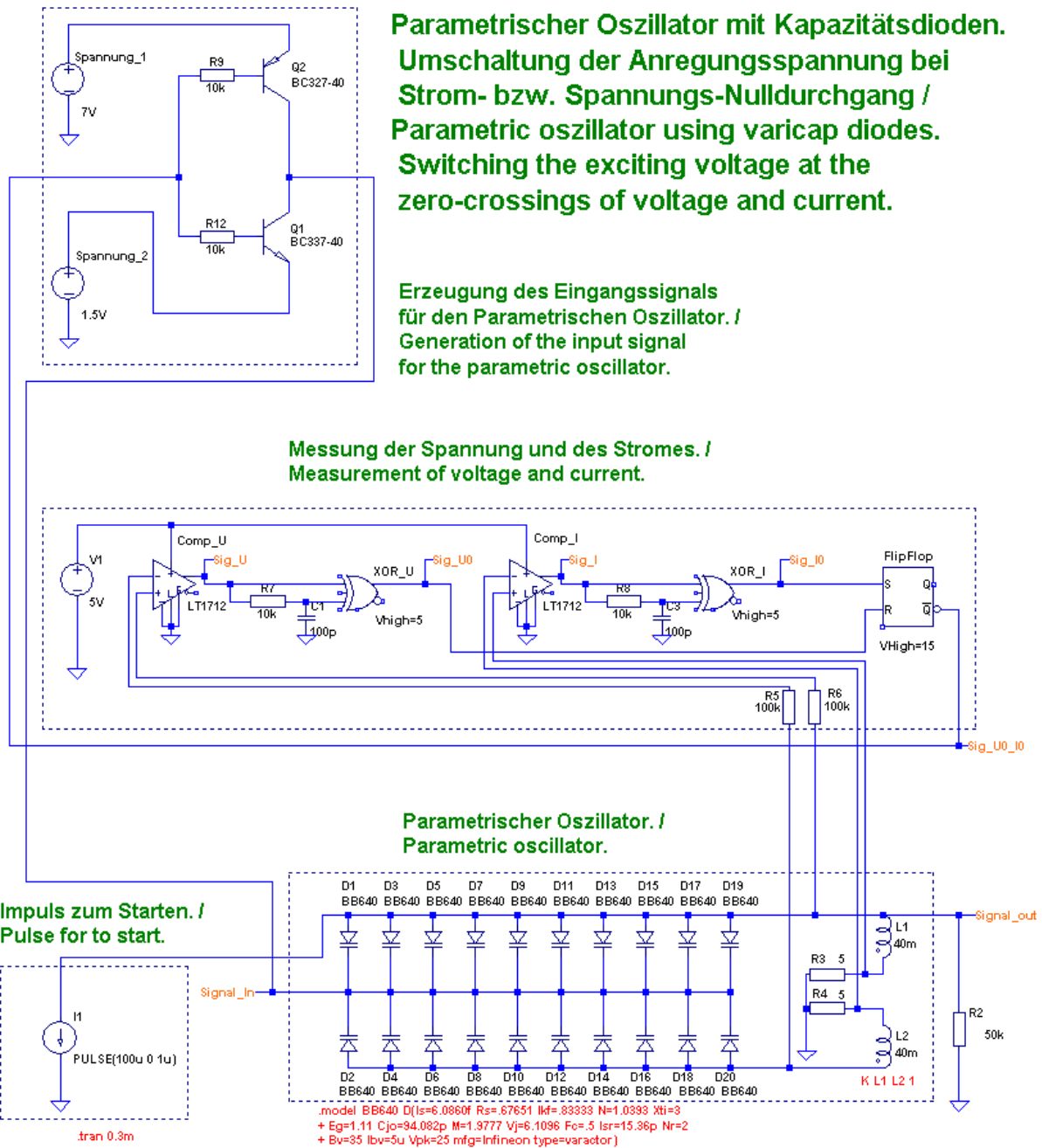
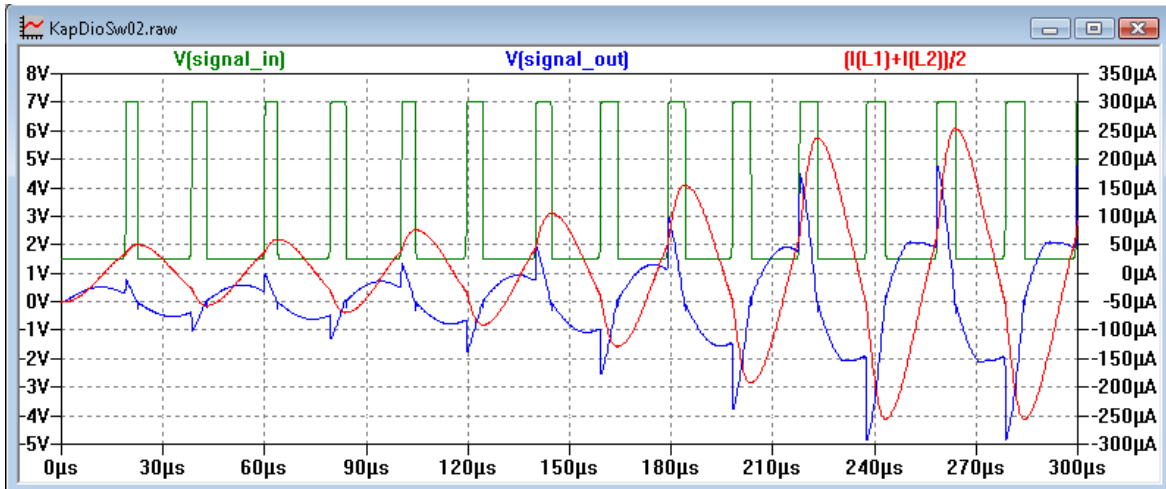Figure 13: Circuit design using varicap diodes with auto-trigger.

Figure 14: Results of LTspice simulation for varicap self-triggering design of Fig.13.

5 Future extension of work

It has been shown by simulation and real circuit construction that parametric oscillators can be built in a self-triggered mode. As expected, an increase of oscillator currents and voltages requires feeding the required energy by the variable device into the circuit. For an oscillator to increase amplitudes by space energy itself, it is required that the variable device works in a non-feedback mode. This means that energy is pumped from space time to the oscillator where energy is only needed for "enabling" this mechanism, like a basis voltage of a transistor controlling a high emitter-collector current. This feedback-free mechanism could be provided for example by field effects. The permittivity of the material in a capacitor could be changed periodically by an electric field. To achieve this without expending too much energy, a resonance mode of the material could be utilized.

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