DFEM-Simulation of a Zero-point-energy Converter with realisable Dimensions and a Power-output in the Kilowatt-range.

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Abstract

In precedent work, the author presented a method for the theoretical computation of zero-point-energy converters, called Dynamic Finite-Element-Method (DFEM). In several articles some examples for the conversion of zero-point-energy have been demonstrated, which deliver an output power in the Nanowatt- or in the Microwatt- range, which is a fundamental proof of the principle, but not sufficient for any technical application.

The way towards a powerful zero-point-energy converter in the Kilowatt-range needed some additional investigation, of which the results are now presented. Different from former fundamental basic research, the new converter has to be operated magnetically, because the energy-density of magnetic fields is much larger the energy-density of electrostatic fields, namely by several orders of magnitude.

In the article here, the author presents step by step the solution of the theoretical problems, which now allows the theoretical construction of a zero-point-energy converter in the Kilowatt-range. The result is a model of a zero-point-energy motor with a diameter of 9 cm and a height of 6.8 cm producing 1.07 Kilowatts.

1. Definition of the project

A principle proof of the utilization of zero-point-energy was given in [Tur 09]. A basic understanding of the physical fundament how to convert zero-point-energy was shown in [Tur 10a], but there it was not yet possible to present a model for a machine with realizable parameters. The first theoretical model with realizable parameters has been published in [Tur 10b], but the output power was so small, that only acoustic noise could be produced, which requires very low power. The article presented here is the last logical step in this theoretical train of thoughts, which shows the theory of a powerful zero-point-energy converter and gives hope for technical utilization. The Kilowatt zero-point-energy engine presented here, needs less space then a washing-machine. From the point of zero-point-energy conversion, the power-density could even be much larger, but the material gives restrictions to the power-density in order not to be damaged during operation. Restrictions come for instance from the electrical current in copper wires, or from the speed of the revolution of a rotation magnet, which should not damage the bearing.

With the model presented here, the theory is developed far enough, that an experimental verification is desirable now, so that the next step is not a theoretical one, but an experimental one.

2. A first approach to the solution

Our solution is a continuation of the DFEM-model known from [Tur 10b], working with two coupled oscillations, one is a mechanical oscillation and the other one an electrical oscillation-circuit. The setup is drawn in fig.1.

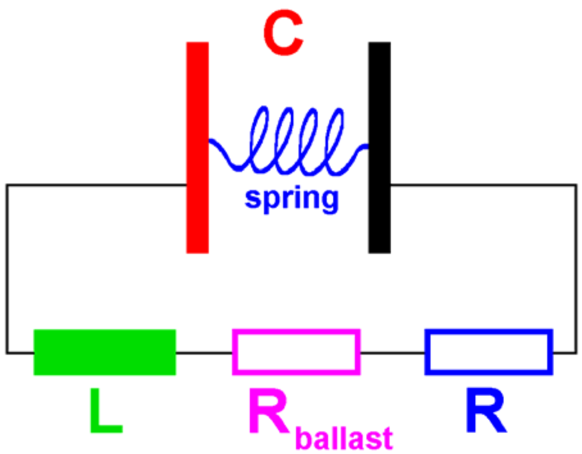

Figure 1:
LCR (electrical) oscillation-circuit, where a capacitor is charged (AC-) electrically, but the distance of the capacitor-plates is variable (by the use of a spring), so that the capacity is not constant. If a mechanical oscillation is coupled with the electrical oscillation in appropriate manner, it is possible to convert zero-point-energy into electrical energy within the electrical circuit and/or mechanical energy within the mechanical oscillation.
By the way: The inductivity of the coil is enhanced by the use of a coil bobbin.

Power can for instance be extracted from the mechanical oscillation of the capacitor plates (as shown in fig.2) as well as from the electrical oscillation by the use of a load resistor R_{Last}, which is operating in series with the Ohm's resistance R of the wire from which the coil is made.

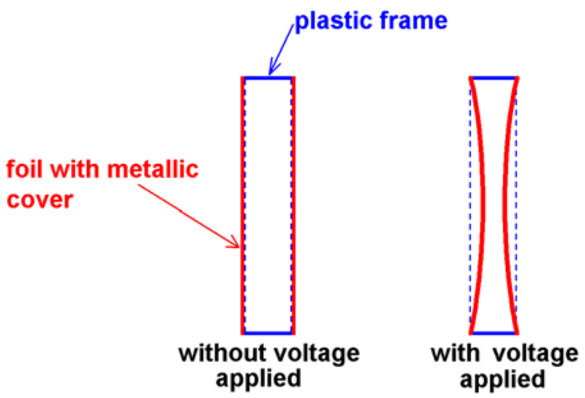

Figure 2:
Variable capacitor with flexible plates, made from thin stretchable plastic-foil, which is covered with a thin metallic film. It can be stretched on a frame. This is an imaginable realization of the capacitor in figure 1, which would be supplied permanently with zero-point-energy so that it can oscillate permanently without consuming classical energy.
The vibration of the plastic-foil might be noticed if it can be arranged in a way that it produces acoustic noise, because the sensitivity of the human ears allows to hear a power of only $10^{-12}\ \mathrm{Watt/m^2}$. The setup should produce noise without any classical power supply.

Unfortunately it can not be extracted more power than only for acoustic noise, which requires typically some Nanowatts or Microwatts. The example shown here was computed to produce a power of only $P = 1.22 \cdot 10^{-9} Watt$, although all system-parameters have be optimized till the very end, and the capacitor plates have a cross section area of several square meters. For a principle proof of the utilization of zero-point-energy this might be nice, because everybody might feel the effect of zero-point-energy very directly by hearing it. But a technical application needs a different setup, which can produce several orders of magnitude more power. This leads us to the following questions:

- By which means would it be possible to enhance the power-density within the setup remarkable ?
- By which means would it be possible to extract remarkable power from the system ?

Furthermore we face an additional question:

- The converter according to fig. 1 and fig. 2 requires a very complicated and sensitive adjustment of the system-parameters. Would it be possible to find a more stable way to operate the systems ?

By the way it should be noticed, that we first want to begin with some thoughts, which can not be regarded as the solution to the power-extraction problem. A possible solution is presented not earlier than in section 6. Nevertheless, we want to regard all the steps which leads us to section 6, because otherwise nobody would understand section 6 on its own. Besides, the steps towards the solution help colleagues to avoid tiresome trying and solving the same problems as me. But for the sake of overview, we will not look into all preliminary blind alleys with all details. The very details are written only for the final solution in section 6.

Among the three above questions we want to start out with the last one first.

3. Stabilizing the operation of the zero-point-energy converter by pulsed signals

The problem with the adjustment of all system-parameters of the zero-point-energy converter results from the time-drift of the both resonances (the mechanical and the electrical one), which have to be adjusted exactly to each other. If both resonance-frequencies are not identical, which is normally the case due to practical reasons (for instance such as tolerances), the phase-difference between the both oscillations increases as a function of time. The consequence is that the oscillations run away from each other, and the adjustment of the propagation-speed of the forces of the interaction will become worse within a certain time of operation. This causes a limit of the conversion of zero-point-energy only due to the apparatus in use, as can be understood as following:

Decreasing adjustment of the propagation-time of the forces of interaction also decreases the amount of energy converted per time, which is the converted power. Finally the system comes into a state, where it can no longer be accelerated (or even supported) by zero-point-energy. This means, the system might run into a stable state of operation, which is kept by zero-point-energy, but in this state of operation the system can not give away any energy-output. If some energy should be extracted, the adjustment of all system-parameters should be renewed. Perhaps the system might even come to standstill, because the support with zero-point-energy is even missing completely. From there we come to the idea, which engineers call “phase lock”:

If we want to extract power continuously, we have to solve the problem of adjustment of both resonances to each other. Periodic input pulsed signals could be the way for renewing this adjustment periodically. These signals shall act similar like a trigger, which resets the adjustment of all system-parameters from time to time, bringing back the system into a well defined initial state with optimal adjustment of the resonances to each other. From this moment of “triggering”, the resonances begin to drift again, but the next trigger-pulse will be given much earlier than the adjustment becomes seriously bad. Thus we investigated the DFEM-Simulation of a triggered operation.

For electrical triggering is much easier than mechanical triggering, it was decided to try the following: The mechanical position shall be the orientation for the moment, at which the electrical trigger-pulse shall be given into the system. The electrical trigger-pulses shall be given into the circuit as a voltage as shown in fig.3, which can be understood as an upgrading of fig.1.

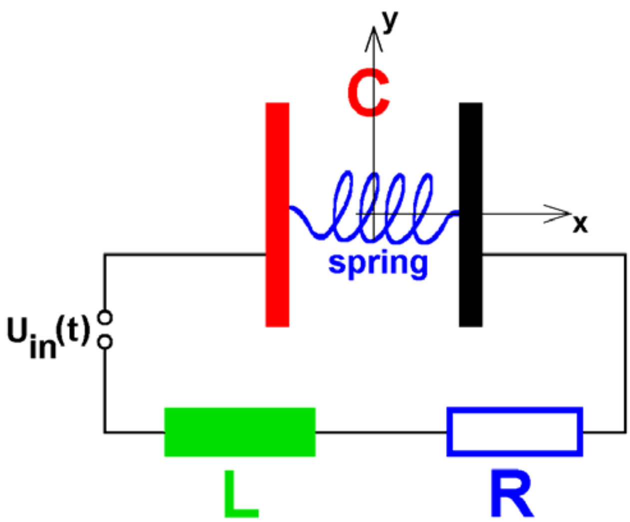

Figure 3:
Insertion of trigger-pulses to our zero-point-energy converter, with the purpose to make the adjustment between the mechanical resonance and the electrical resonance stable in time (phase lock).

The trigger-pulses can be given as shown in fig.4. They are actuated at a well defined geometrical position of the mechanical part of the sytem. Of course the trigger-pulses themselves shall consume as low power as possible, otherwise they would feed the engine instead of the zero-point-energy.

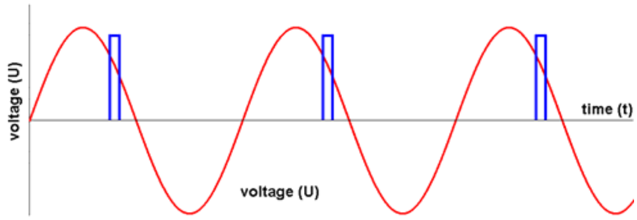

Figure 4:

Red: Mechanical oscillation, at which the trigger-pulses are orientated.

Blue: Trigger-pulses with very low power.

The differential equation on which the electrical oscillation is based, can be derived from the use of Kirchhoff's voltage rule [Ger 95]:

$$U_L + U_R + U_C = U_{in}(t)$$

$$\Rightarrow \; U_L + U_R + U_C = -L \cdot \ddot{Q} + R \cdot \dot{Q} + \frac{1}{C} \cdot Q = U_{in}(t). \qquad (1)$$

with the voltage of the capacitor, the coil and the resistor as following:

according to the definition of the capacity $C = \frac{Q}{U} \;\Rightarrow\; U_C = \frac{1}{C} \cdot Q$ (2)

according to the law of induction: $U_L = -L \cdot \frac{d}{dt} I = -L \cdot \ddot{Q}$ (3)

according to Ohm's law: $U_R = R \cdot I$ (4)

This is an inhomogeneous differential equation of 2nd order, with a disturbance function according to fig.4.

The mechanical oscillation follows the differential equation:

$$m \cdot \ddot{x}(t_i) = -D \cdot \left(x(t_{i-1}) - \frac{CD}{2} \right) + \frac{1}{4\pi\varepsilon_0} \cdot \frac{Q^2(t_i)}{\left(2 \cdot x(t_i)\right)^2} \qquad (5)$$

based on the spring-force and the Coulomb-force with m=mass and D = Hooke's spring constant

The capacitor plates are mounted symmetrically with regard to the origin of coordinates, so that their positions are $-x(t_i)$ and $+x(t_i)$. Thus we write Coulomb's force between the capacitor-plate as $F_C = \frac{1}{4\pi\varepsilon_0} \cdot \frac{Q^2}{\left(2 \cdot x(t_i)\right)^2}$, because the distance between the capacitor plates is $2 \cdot x(t_i)$.

For the computation of the force of the helical spring, we have to use a totally different length, namely the alteration of the spring length relatively to the spring without load. If CD = length of the unloaded spring, the alteration of its length relatively to CD can be written as $CD - 2 \cdot x(t_i)$, not forgetting the algebraic sign of $x(t_i)$. If we regard the motion of the capacitor-plates a symmetrically with regard to the origin of coordinates, (where the coordinate-system is fixed in the middle of the capacitor, each half of the spring follows exactly half of $CD - 2 \cdot x(t_i)$, so that the force of the spring, acting on each of the capacitor plates is $F_F = -D \cdot \left(x(t_i) - \frac{CD}{2} \right)$, as written in equation (5).

The coupling between the mechanical oscillation and the electrical oscillation can be recognized when regarding the last summand of equation (5), where the electrical part of the apparatus carries out its influence onto the mechanical part of the apparatus. But we also recognize it in equation (1), where the capacity C is influenced by the mechanical oscillation.

Actually this concept allows a stable operation of the zero-point-energy converter, as can be seen in fig.5 and fig.6.

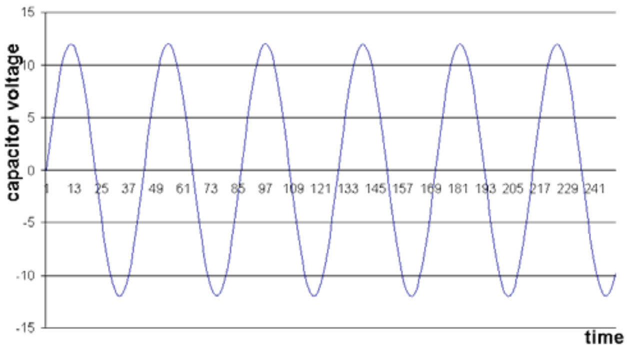

Figure 5:
The electrical charge in the capacitor oscillates with a sine.

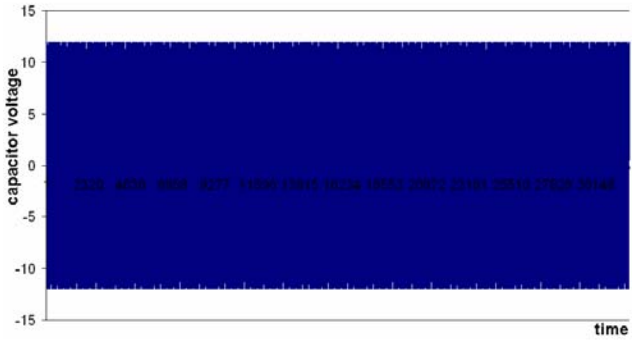

Figure 6:
If we observe the oscillation over long time, the graphics display does not dissolve all pixels of the sine, but it becomes very clear, that the operation runs stable.

If we want to extract energy from the system, we can try to insert a load resistor as a consumer of energy. This load resistor has to be inserted into equation (1) in series with the resistance of the wire from which the coil is made, following equations (6) and (7).

$$R = R_{coil} + R_{load} \tag{6}$$

with an extraction of power: $$P_{extract} = U_{load} \cdot I_{load} = R_{load} \cdot I_{load}^2 \tag{7}$$

For the extraction of power, we optimize the load resistor in such way, that it extracts just the amount of energy coming from the zero-point-energy. A larger load resistor would decrease the oscillation and a smaller load resistor would have the consequence that the oscillation would increase during time.

But the result of these DFEM-simulations was, that the triggered zero-point-energy converter allowed only few microwatts to be extracted. This is more than the acoustic power to be extracted from the setup without triggering and phase lock, but it is not really satisfactory. Besides, the capacitor had plates of 6 m^2 up to 20 m^2 (for different trials) with power-output between Nanowatts and few ten microwatts.

Although the gained power is very low, the result is encouraging, because the gained power is by several orders of magnitude larger than the input-power of the trigger-pulses. Obviously the trigger-pulses are only needed for the adjustment of the system and not as an energy-supply. There have been examples of simulation with a mechanical power-gain which is more than a factor of 10^6 larger than the energy-supply of the input trigger-pulses.

Furthermore it was observed, that the mechanical oscillation of the capacitor plates acquires much more energy than the electrical oscillation in the LCR-circuit. This leads us to the question, whether a mechanical extraction of energy is more efficient than the electrical extraction of energy. In order to try this, a constant mechanical friction was included into the DFEM-algorithm, not thinking about the question how this constant mechanical friction could be realized in praxis (especially with regard to the capacitor plates of several m^2).

For this purpose we expand differential equation (5) by a constant load force F_{load} and thus come to the differential equation (8) of a damped oscillation.

$$m \cdot \ddot{x}(t_i) = -D \cdot \left(x(t_{i-1}) - \frac{CD}{2} \right) + \frac{1}{4\pi\varepsilon_0} \cdot \frac{Q^2(t_i)}{\left(2 \cdot x(t_i)\right)^2} - F_{load} \tag{8}$$

The constant load force acts in counter-direction with regard to the acceleration (thus the negative algebraic sign), and it can be switched on at an arbitrary moment of time. By this means a converter has been simulated with

an input-power (trigger) of $P_{input,electr} = 1.354 \cdot 10^{-7} Watt$

and an electrical output-power of $P_{output,electr} = 1.350 \cdot 10^{-7} Watt$

plus mechanical-output $P_{output,mechan} = 2.611 \cdot 10^{-5} Watt$

Even if the extracted power exceeds the input-power of the electrical trigger-pulses by a factor of 194, the total power gain is only few more than 260 microwatts (see fig. 7), although the capacitor had plates of $6\,m^2$ (difficult to realize, and thus not satisfactory).

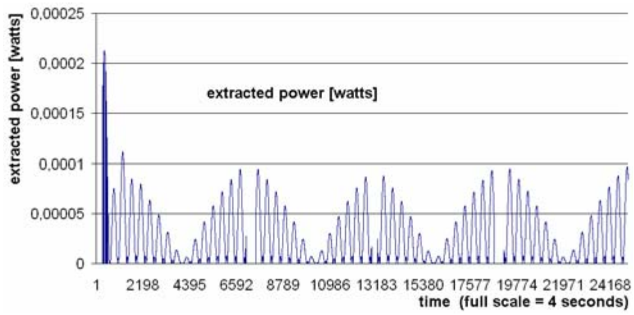

Figure 7a: Extracted mechanical power

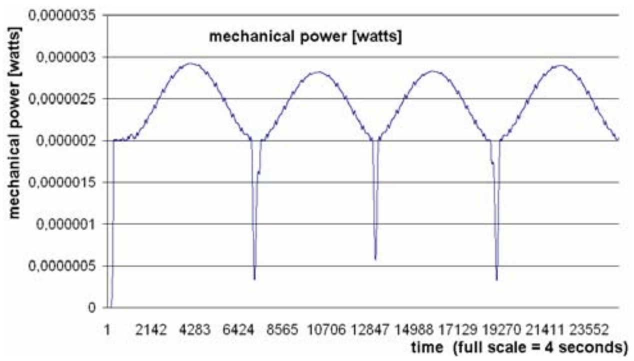

Figure 7b: Mechanical power staying in the oscillator.

The electrical power is negligible.

This example is for sure not the solution of the power-extraction problem, even if the trigger-pulses help us to come into the upper microwatt-range.

Comparative tests with a load-force of friction proportional to the velocity of the capacitor plates $F_{load} = \beta \cdot \dot{x}$ allow us to enter the milliwatt-range, but I even regard this not as the solution of the power-extraction problem. Fig.8 is based on a load-force of friction proportional to the velocity and comes to a power-gain of a bit more than 4.5 milliwatts. The trigger-pulses are orientated with their phase relatively to the mechanical oscillation. At the beginning of the operation, there is not yet any mechanical power in the system, and the trigger-pulses initiate the oscillation at all. At this time, the amplitude of the oscillation is growing permanently. At the moment t = 100 sec., the mechanical load-force is switched on with a friction keeping the amplitude constant from there on. From t = 100 sec. up to t = 200 sec., a mechanical power-extraction of a bit more than 4.5 milliwatts is observed as stated above. Obviously the mechanical damping reduces the frequency of the oscillation, which is rather typical for damped oscillations. But this does not disturb our system, because the trigger-pulses are orientated relatively to the mechanical deflection.

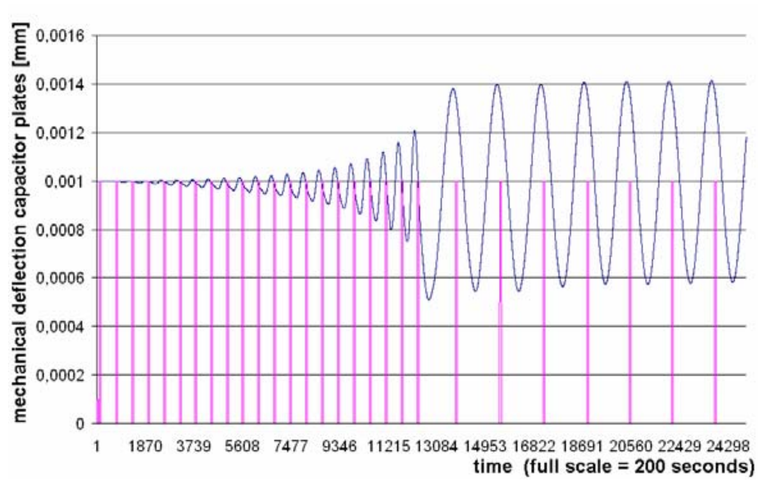

Figure 8:

blue: Mechanical deflection of the capacitor-plates in meters. The position of rest is located at 1.0 Millimeters = 0.001 Meter. The deflection is to be understood relatively to the rest position.

purple: Electrical power-supply of the trigger-pulses. They have an amplitude of 0.1 Volt and are rather short.

For the capacitor-plates in the simulation example have a mass of 440 kg per each, the stiffness of the springs is rather high, with a Hooke's spring constant of 86487 N/m. This means that the converter has no practical sense at all, even if it appears realizable by principle. But – how to extract few milliwatts from such large capacitor-plates ? The question will remain unsolved, because we will soon see a better design.

4. Power extraction from the coil

After we found out, that the capacitor is almost incapable to release its energy, we want to try, whether the coil is capable to release its energy. This requires some impedance-transforming, so that we come to a design as seen in fig.9.

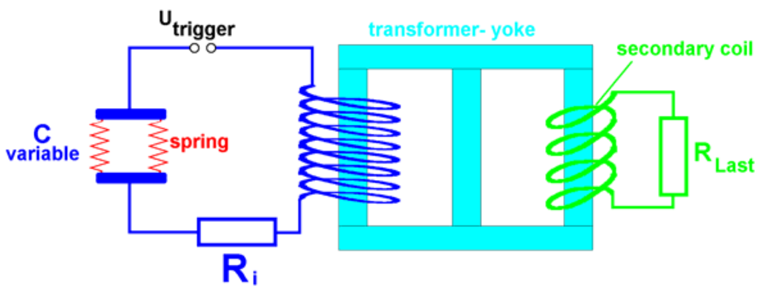

Figure 9: Suggestion for making the extraction of energy from the zero-point energy converter better.

There the coil bobbin from fig.1 is extended to be yoke of a transformer now, so that coil in the LRC-oscillation circuit will be the primary-coil of a transformer, from whose secondary-coil we can extract energy. This arises the hope, that the impedance of the coil can now be transformed in such way, that we can gain more energy and/or power than before.

The primary-coil produces a magnetic field due to its current [Stöcker S.441], which is

$$H = \frac{n \cdot I}{\sqrt{l^2 + 4R^2}} \tag{9}$$

with n = number of windings in the primary coil
l = length of the coil-body
R = radius of the coil-body

From there we calculate the magnetic flux and the voltage induced in the secondary-coil:

$$B = \mu_0 \mu_r \cdot H \quad \Rightarrow \quad \phi = \int_A \vec{B} d\vec{A} \quad \Rightarrow \quad U_{ind} = -m \cdot \frac{d\phi}{dt} \tag{10}$$

with m = number of secondary -windings

If we put the equations into each other, assuming a homogeneous magnetic field, we come to a magnetic flux in the yoke, which has the same value in the secondary-coil as in the primary-coil:

$$\phi = \int_A \vec{B} d\vec{A} = B \cdot A = \mu_0 \mu_r \cdot \frac{n \cdot I}{\sqrt{l^2 + 4R^2}} \cdot \pi R^2 = \mu_0 \mu_r \cdot \frac{\pi R^2}{\sqrt{l^2 + 4R^2}} \cdot n \cdot \frac{dQ}{dt} \quad , \tag{11}$$

The notation has been adapted to the use in the differential equations of the coupled oscillations. From there we come to the relation of the electrical currents in the secondary-coil relatively to the primary-coil:

$$\underbrace{U_{ind,2} = -n_1 \cdot \frac{d\phi}{dt}}_{because\ of\ \phi_1=\phi_2} = -\mu_0\,\mu_r \cdot n_1^2 \frac{\pi R_1^2}{\sqrt{l_1^2+4R_1^2}} \cdot \frac{d^2Q_1}{dt^2} = -L_2 \cdot Q_2 = -\mu_0\,\mu_r \cdot n_2^2 \frac{\pi R_2^2}{\sqrt{l_2^2+4R_2^2}} \cdot \frac{d^2Q_2}{dt^2} \quad , \tag{12}$$

where we give the values of the inductivities of the both coils as

$$L_1 = \mu_0\,\mu_r \cdot \frac{\pi R_1^2}{\sqrt{l_1^2+4R_1^2}} \cdot n_1^2 \quad \text{and} \quad L_2 = \mu_0\,\mu_r \cdot \frac{\pi R_2^2}{\sqrt{l_2^2+4R_2^2}} \cdot n_2^2 \ . \tag{13}$$

This allows us to convert the values of the primary sizes $Q_1, \dot{Q}_1, \ddot{Q}_1$ into the values of the secondary sizes $Q_2, \dot{Q}_2, \ddot{Q}_2$ (see index), so that we can calculate the power-extraction of the system. This is the way, how we include the secondary-coil into the differential equations of the oscillation. The load resistor can be translated into a resistor in parallel to the primary-coil, which can then be inserted into the differential equations of the oscillation.

The translating computation requires a longsome derivation, finally resulting in the differential equations (14), which shall not be derived here explicitly, because we will soon observe, that this way is also not the very solution of out power-extraction problem.

$$\ddot{Q}_L = \underbrace{\frac{-1}{C\cdot(R+R_V)}\dot{Q}_L}_{\text{term for the extraction of power}} + \underbrace{\frac{-1}{C\cdot L}\cdot\frac{R_V}{R+R_V}Q_L}_{\text{term for the capacitor}} + \underbrace{\frac{R}{L}\cdot\frac{R_V}{R+R_V}\dot{Q}_L}_{\text{term for the Ohm's resistance of the coil's wire}} \underbrace{-\frac{1}{L}\cdot\frac{R_V}{R+R_V}\cdot U_0(t)}_{\text{term for the voltage of the trigger-pulses}} \quad , \tag{14}$$

where we have: R = Ohm’s resistance of the coil’s wire
R_V = load - resistor
C = capacity
L = inductivity
$U_0(t)$ = trigger-pulses (if applicable)

With this construction it was possible to enhance the extracted power to 63 milliwatts, but still using the unrealistic large capacitor-plates as have been used for the simulation-examples of fig.8. The extracted power is low enough not the justify the enumeration of the more than 20 parameters of the system, which have been necessary for the DFEM-simulation of the differential equations containing equation (14). The situation is not advanced by the suggestion of fig. 9 very much. We will have to try something else.

5. Variability of the coil

After all we found, we come back to our questions at the end of section 2, which should guide us towards the solution of out power-extraction problem. We now see, that the pulse-operation is not the only way.

First of all, we remark, that an enhancement of the power-density within the system is absolutely necessary. If there is low energy and power within the system, there is not much to be extracted. The weak point in the design is the capacitor with only two massive (thick) parallel plates. This type of capacitor is known for its low capacity. The capacitor on which fig.8 is based had a capacity of only 79.7 nF with a surface of the plates of $6\,m^2$. It should be mounted like a window.

If we want to enhance the power-density of the system, we should respect equations (15) and (16) and come to the point to make the energy within the capacitor about the same large as the energy within the coil. This means that we have to use a capacitor much larger than what we did up to now. This should help us to have the same amount of energy in the electric circuit as in the mechanical oscillation.

energy of the capacitor $E_C = \frac{1}{2} C \cdot U^2$ (15)

energy of the coil $E_L = \frac{1}{2} L \cdot I^2$ (16)

An enhancement of the capacity can be realized rather easily with a standard commercial capacitor. But this means that we lose the possibility to have an oscillation of the capacitor-plates. So we have to go back to the very beginning and look again to fig.1. The variability of the electric LC- oscillation circuit can be achieved not only by the capacitor but also by the coil. We need this variability in order to control the speed of propagation of the field of the interacting forces, but this control can be realized either by the capacitor or by the coil. So we come to an alternative design as shown in fig.10. There we have a coil with the coil bobbin moving inside the windings, which gives rise to an alteration of the inductivity of the coil, as soon as the coil bobbin has a permeability different from 1, this is $\mu_r \neq 1$.

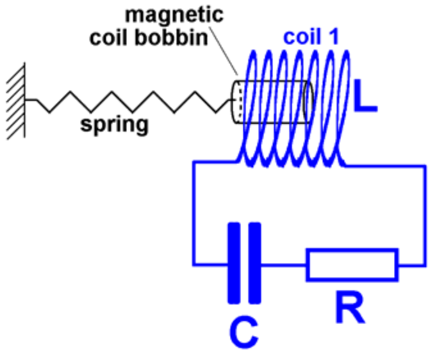

Figure 10:
Suggestion for an improvement of the zero-point energy motor namely by improving the energy inside the system, which allows to improve the energy-coupling between the mechanical part of the system and the electrical part of the system. The variation of the inductivity of the coil is due to an oscillation of the coil bobbin, which has a permeability different from 1.

The permeability of the coil bobbin can be very large (depending on appropriate material), so that the variation of the inductivity of the coil is very large. The coil bobbin is fixed to a spring which makes the bobbin oscillate mechanically, so that we now do not alter the capacity but we alter the inductivity in the LC-circuit. Thereby the electrical energy-density of the system can be enhance so much, that the electrical circuit contains about the same amount of energy as the mechanical oscillation. This helps us to get rid of the weak link in the system, which has been the electrical part.

The disadvantage of the procedure is the rather large mathematical effort for the DFEM-calculations, because we now have to calculate the inductivity of the coil as a function of the position of the coil bobbin. This causes that we can not use any standard-formulas from any formulary tables. This brings us into the necessity to derive the behaviour of each winding individually, and to derive the behaviour of the whole coil as a summation of the behaviour of each winding. Therefore we chose a setup as shown in fig 11.

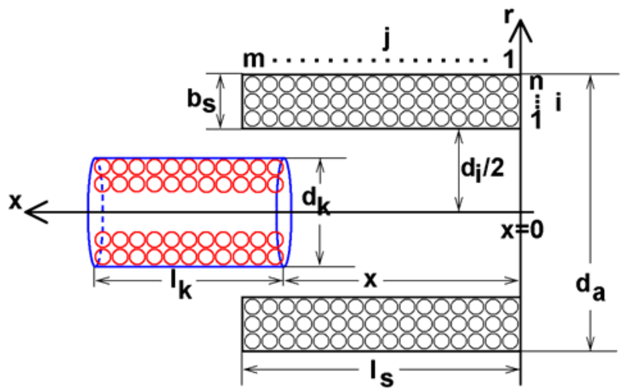

Figure 11:
Characterization of the parameters of a coil bobbin (blue), which is emulated as a cylindrical coil (red), and which is oscillating inside a real cylindrical coil (black). On the one hand, the coil bobbin takes up Coulomb-forces from the magnetic field of the outside cylindrical coil, but on the other hand, the coil bobbin induces a voltage into the outside cylindrical coil due to its movement relatively to the outside cylindrical coil. The crucial point is, that the coil bobbin influences the inductivity of the coil.

Abbreviations:
l_s = length of the coil body
b_s = latitude of the coil body
d_i = inner diameter of the coil body
d_a = outer diameter of the coil body
D_d = diameter of the coil's wire
n = number of windings in radial direction
m = number of windings in axial direction
d_k = diameter of the coil bobbin
l_k = length of the coil bobbin
x = deflection of the coil bobbin relatively to the rest position
l_s-x = retrection depth of the coil bobbin into the outside cylindrical coil

The theoretical simulation now goes as following:
The magnetic field of a cylindrical permanent magnet has the same structure as the magnetic field of a cylindrical coil, thus we can calculate both fields in the same way. Therefore we use the law of Biot-Savart and calculate the magnetic field of each single conductor loop (as shown in fig.12). The magnetic field of one conductor loop of the coil causes a Lorentz-force onto each single conductor loop of the coil simulating the coil bobbin. If we calculate in such way the interaction between each pairs of all single conductor loops (in combination), we can sum up all forces of interaction until we get the total force between the coil bobbin and the cylindrical outside coil. This calculation was done for each arbitrary position of the coil bobbin relatively to the cylindrical outside coil, so that a force-deflection curve was computed.

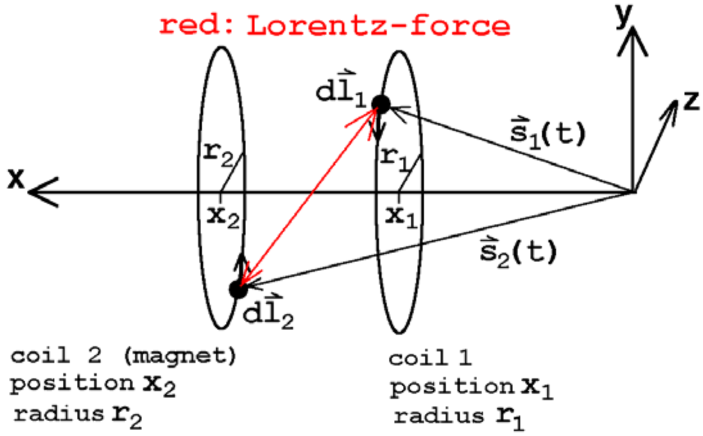

Figure 12:
Illustration of the parameters of two single conductor loops interacting with each other. The parameters are used for the application of Biot-Savart's law and for the calculation of the Lorentz-forces between the conductor loops.

The field produced by a finite conductor element of loop 1 at the position of a finite conductor element of loop 2 is (see [Jac 81])

$$dH = \frac{q_1 \cdot \vec{v}_1 \times \left(\vec{s}_1 - \vec{s}_2\right)}{4\pi \cdot \left|\vec{s}_1 - \vec{s}_2\right|^3} \cdot \frac{d\varphi}{2\pi} \qquad (17)$$

Summation over all finite conductor loop elements of loop 1 brings us to the total field produced by this loop:

$$\vec{H} = \oint_{(A)} d\vec{H} \qquad \Rightarrow \qquad \vec{B} = \mu_0 \cdot \mu_r \cdot \vec{H} \qquad (18a)$$

For the magnetic field of a cylindrical permanent magnet has the same structure as the magnetic field of a cylindrical coil, we can use this consideration for the calculation of the magnetic field of both components in the same way. The Lorentz-force acting onto the conductor loop elements of loop 2 are then calculated in the usual way:

$$d\vec{F} = I_2 \cdot \left(d\vec{l}_2 \times \vec{B}\right) \qquad (18b)$$

If we conduct the outer vector product within the integrals, then perform the integration, and finally sum up all the forces between all finite conductor loop elements (using the cylindrical symmetry of the setup), we come to the following result:

The field of the permanent magnet (loop 2) can be separated into two components, a radial and an axial component. A motion of the magnet will cause Lorentz-forces. The Lorentz-forces due to the radial component of the field want to move the electrons in the coil (loop 1) perpendicular to the direction of the wires, which is a direction, in which electrical current is not possible. This means that the whole wires take mechanical forces, which we know in every day's life to be the magnetic forces between a magnet and a coil. Their calculation has been demonstrated above. On the other hand, the Lorentz-forces due to the axial component of the magnetic field of the permanent magnet (with its motion) want to move the electrons in the coil (loop 1) into the direction of the wires, where they can flow easily. This gives rise to induction, as we know it in every day's life from the induced voltage in the coil.

The magnetic flux, which the coil bobbin causes in the coil can be derived after some calculation to be

$$\phi = \int \vec{B}\, d\vec{A} = \mu_0 \cdot H_x \cdot A = \frac{\mu_0 \cdot \pi \cdot r_1^2 \cdot r_2^2 \cdot I_2}{2 \cdot \left(r_2^2 + \left(x_1 - x_2 \right)^2 \right)^{3/2}} \tag{19}$$

The current I_2 in coil no.2 (which represents the permanent magnet, loop 2) is to be understood as the current which is necessary to emulate the permanent magnet by a coil.

The derivative of the magnetic flux is the induced voltage in the coil, by which the mechanical motion of the permanent magnet acts into the coil and thus into the electric circuit. Its formula can be developed as following:

$$U_{ind} = -\frac{\Delta \phi}{\Delta t} = \frac{-\mu_0 \cdot \pi \cdot r_1^2 \cdot r_2^2 \cdot I_2}{2 \cdot \Delta t} \cdot \left(\frac{1}{\left(r_2^2 + \left(x_1 - x_2(t) \right)^2 \right)^{3/2}} - \frac{1}{\left(r_2^2 + \left(x_1 - x_2(t - \Delta t) \right)^2 \right)^{3/2}} \right) \tag{20}$$

With these formula we are now able to calculate
- the magnetic forces, which the coil with electrical current causes onto a permanent magnet, and
- the induced voltage, which a permanent magnet in motion brings into a coil.

On this basis we can now perform the DFEM-simulation of the system shown in fig.10.

From this simulation we learn a technical problem, which still prevents us from extracting noteworthy power from the zero-point-energy converter system. The difficulty consists of two aspects, which conflict each other. They are explained as following:

The first aspect results from the mass of the permanent magnet. If we activate the converter system by a mechanical motion of the permanent magnet, the geometrical oscillation of the permanent magnet causes the induction of some voltage-pulses into the coil, but this electrical energy is not enough to excite the electrical oscillation of the LCR-circuit (at least due to the damping of the Ohm's resistance of the wire of the coil). Because of the mass inertia of the permanent magnet, which has to be accelerated and decelerated all the time due to its oscillation, it is impossible to enhance the velocity of motion of the permanent magnet enough, that it will bring a voltage into the coil, which is sufficient to arise a permanent oscillation of the electrical charge in the LCR-circuit. The energetical coupling between the two oscillations (the mechanical and the electrical oscillation) is constrained seriously by the mass inertia of the permanent magnet. We can also regard this aspect from the point of view of the spring (which moves the permanent magnet): If the spring is not very strong (low Hooke's constant), the permanent magnet oscillates rather slow, and the low velocity of the magnet is responsible for the problem, that the induced voltage in the coil is very low. But on the other hand, if the spring is strong (large Hooke's constant), the mechanical amplitude of the magnet is rather low, which also results in the problem, that the induced voltage in the coil is very low. In any case, the electrical oscillation can not be properly coupled with the mechanical oscillation.

The other aspect of the difficulty can be seen, if we try to activate the converter system from the electrical side, putting electrical input-pulses into the LCR-circuit. Due to the Ohm's resistance of the wire of the coil, the electrical oscillation is damped. And the energy of the electrical oscillation is absorbed by the resistance of the wire of the coil so fast, that it is impossible to activate the mechanical oscillation of the permanent magnet via Lorentz-forces. Very low amplitudes are possible, which do not allow satisfactory power-conversion from the zero-point energy.

If we would like to adjust the mechanical oscillation of the permanent magnet to the electrical oscillation of the LCR-circuit, we have to adjust the resonance-frequencies of both oscillations to each other. Therefore we should decrease the mass (inertia) of the permanent magnet (together with Hooke's spring constant) so far, that the mass density of the permanent magnet is lower then the mass density of air. Obviously this is not realistic, but our aim was the theoretical development of a realizable zero-point-energy converter. This means that the setup according to fig.10 is not even capable for a sensible operation of a zero-point-energy converter at all. To say it in clear words: The setup according to fig.10 is not a zero-point-energy motor. It can not convert zero-point-energy by principle.

Nevertheless, this setup helps us mentally to find a way towards a good design for an appropriate zero-point-energy motor. With other words: From the setup in fig.10, we now come to the solution of our energy-extracting problem, namely as following:

We found that the only problem in our design was the mass inertia of the permanent magnet in combination with the fact, that the permanent magnet has to change its direction of motion all the time (twice per period). If we would find a possibility to avoid, that the permanent magnet has to go back and forth all the time, its mass inertia would no longer be a problem. A continuous periodic motion – this would be the solution of our problem. And it is not very complicated. It is a circular motion, a rotation. That's all we need to add into our concept. A circular motion does not need oscillating acceleration and deceleration, but it repeats its position periodically nevertheless. Thus we can enhance the speed of the motion without needing the strong spring-force at all. Mass inertia does not disturb our possibility to enhance the speed of the circular motion. The periodicity of the rotation can be easily understood, if we regard the Cartesian components of this motion. This approach will indeed be our solution of the energy conversion problem as well as of the energy extraction problem.

6. The solution: A zero-point-energy motor with a rotating magnet

For the mechanical rotation, we want to use a magnet with cylindrical shape, but for the electrical induction of voltage into the coil, a magnet with a homogeneous field is preferable. (And besides, that calculation is easier with a homogeneous magnetic field, which is indeed important for the elapsed time to run the DFEM-algorithm), so that we decide to use a magnet according to fig.13.

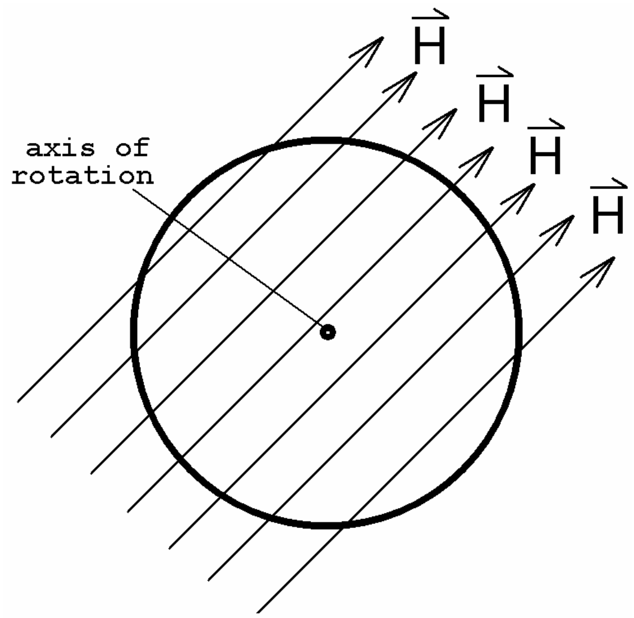

Figure 13: A cylindrical magnet, which produces a homogeneous magnetic field. Such magnets are available in commercial magnet shops.

This magnet has to rotate inside a coil with "n" windings. All windings can be located at the same position in good approximation. Other then in section 5, this is a good approximation here, because the magnet interacts with the coil not by translation but by rotation.

Also due to the rotation we now have to deal with a torque acting onto the magnet (and not with linear forces as it was the case in section 5). This means that we want to take the motion as a pure rotation in the DFEM-simulation. Consequently we have to calculate the torque between a magnetic dipole and the magnetic field of the coil. Because of Newton's axiom "actio = reactio", the magnet gets the same torque as the coil, so that we can calculate the torque of the magnet in the field of the coil or on the other hand the torque of the coil in the field of the magnet as well. Due to the fact that the magnetic field of the permanent magnet is homogeneous, the calculation of the torque onto the coil inside the field of the permanent magnet is the more efficient variant, so that we will follow this way.

The magnetic dipole moment $\vec{m}$ of a coil is given in equation (21), the torque of the coil in the magnetic field is given in equation (22) [Tip 03].

$$\vec{m} = n \cdot I \cdot \vec{A} \ , \qquad \text{mit} \quad I = \text{electrical current}, \quad n = \text{number of windings} \tag{21}$$

$$\vec{M} = \vec{m} \times \vec{B} = n \cdot I \cdot \vec{A} \times \vec{B} \qquad \vec{A} = \text{cross section area and normal vector}, \quad \vec{m} = \text{dipole moment} \tag{22}$$

$$\vec{B} = \mu_0 \vec{H} \qquad \vec{M} = \text{torque} \tag{23}$$

This calculation of the torque represents the mechanical influence of the coil onto the magnet. This allows us to calculate, how the electrical circuit acts onto the mechanical motion.

The opposite direction of the coupling of the two motion, namely the influence which the rotation of the magnet brings into to the electrical circuit has to be calculated via the induced voltage, which the rotating permanent magnet brings into the coil. This can be performed via the magnetic flux ϕ, which the permanent magnet brings into the coil. It is

$$\phi = \int_A \vec{B} \cdot d\vec{A} = \vec{B} \cdot \vec{A} = |\vec{B}| \cdot |\vec{A}| \cdot \cos(\varphi) \qquad \text{with } \varphi = \varphi(t) = \text{angle between the direction of the magnetic field flux lines and the direction of the area and normal vector of the coil.} \tag{24}$$

An illustration can be seen in fig.14.

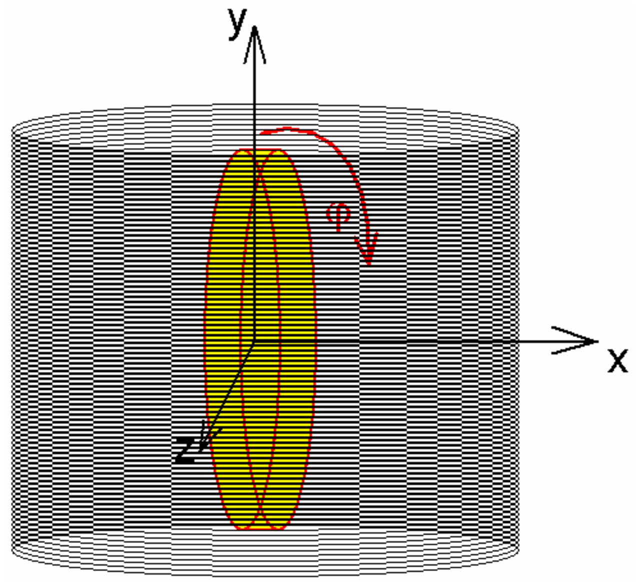

Figure 14:
Placement of the permanent magnet in the coil. The permanent magnet rotates around the x-axis, so that the angle $\varphi(t)$ between the magnetic field flux lines of the permanent magnet and the normal vector of the area of the coil's conductor loops is to be measured relatively to the y-axis.

The induced voltage is now

$$U_{ind} = -n \cdot \frac{d\phi}{dt} = -n \cdot |\vec{B}| \cdot |\vec{A}| \cdot \frac{d}{dt}\left[\cos(\varphi(t))\right] = \underbrace{+n \cdot |\vec{B}| \cdot |\vec{A}| \cdot \sin(\varphi(t)) \cdot \dot{\varphi}(t)}_{\text{use chain rule for derivative}} \tag{25}$$

The one component of the torque, which is responsible for the acceleration and the deceleration of the rotation of the magnet is the x-component, namely M_x . For the vector calculus in equation (22) can be done most easy in Cartesian coordinates, we write (leaving away the arrow over a vector-size means a calculation of its absolute value):

$$\vec{m} = n \cdot I \cdot \vec{A} = n \cdot I \cdot A \cdot \vec{e}_y = n \cdot I \cdot A \cdot \begin{pmatrix} 0 \\ 1 \\ 0 \end{pmatrix} \tag{26}$$

$$\vec{B} = \mu_0 \vec{H} = \mu_0 H \cdot \begin{pmatrix} 0 \\ \cos(\varphi(t)) \\ \sin(\varphi(t)) \end{pmatrix} \tag{27}$$

$$\Rightarrow \vec{M} = \vec{m} \times \vec{B} = n \cdot I \cdot A \cdot \begin{pmatrix} 0 \\ 1 \\ 0 \end{pmatrix} \times \mu_0 H \cdot \begin{pmatrix} 0 \\ \cos(\varphi(t)) \\ \sin(\varphi(t)) \end{pmatrix} = \mu_0 \cdot n \cdot I \cdot A \cdot H \cdot \begin{pmatrix} \sin(\varphi(t)) \\ 0 \\ 0 \end{pmatrix} \tag{28}$$

We come to the crucial x-component of the torque:

$$\mathrm{M_x} = \mathrm{B_0} \cdot n \cdot I \cdot A \cdot \sin(\varphi(t)) \qquad \text{because of } \vec{B}_0 = \mu_0 H \tag{29}$$

The inductivity of a cylindrical coil can be found in every good standard formulary-table [Stö 07]

$$L = \frac{\mu_0 \cdot A \cdot n^2}{l}, \quad \text{with } l = \text{length of the coil} \tag{30}$$

Because the rotation always goes back into its starting-point without any restoring spring-force, we do not have a spring at all, and thus no oscillation in our calculation. Therefore a spring-term in the mechanical differential equation is not to be applied any more here.

The electrical part of system of two coupled differential equations can be used identically as in our former consideration (see for instance section 5) and also follows the equations (1), (2), (3), (4). But we now want to set the input voltage identically to zero, i.e. $U_{in}(t) = 0$, because we do not need any input voltage at all. We will soon see, that the machine is self-running, i.e. it works without any classical energy input. And we will also see, that the machine operates stable, so that it does not need any triggering.

The mechanical part of the differential equations is based on the rotation:

$$J \cdot \ddot{\varphi} = \mathrm{M_x} = \mathrm{B_0} \cdot n \cdot I \cdot A \cdot \sin(\varphi(t)) \tag{31}$$

$$\Rightarrow \ddot{\varphi} - \frac{\mathrm{B_0} \cdot n \cdot I \cdot A}{J} \cdot \sin(\varphi(t)) = 0 \qquad \text{[Dub 90]} \tag{32}$$

with $J = \frac{1}{2} m_T r_M^2 =$ inertia of rotation of the cylindrical magnet

$m_T =$ inertial mass of the magnet

$r_M =$ radius mass of the magnet (half of its diameter)

This is indeed the differential equation to describe a rotation.

The coupling between the differential equations (1), (2), (3), (4) and the differential equation (32) is given via the magnetic (Lorentz-) forces and via the induced voltage.

Our coupled system of inhomogeneous differential equations of 2nd order contains nonlinear disturbance functions. Thus it is sensible to solve it numerically with our DFEM-algorithm. The Sorce-code of the algorithm is printed in the appendix of the article. The central part of the solver can be seen in the body of the main program [Bor 99]. The coupling of the differential equations is explained in the following equations (33) and (34). The Sorce-code of the algorithm has to take additionally constants of integration into account, which are taken from the initial conditions of the system [Bro 08].

$$\ddot{\varphi}(t) = -\frac{\mathrm{B_0} \cdot n \cdot A}{J} \cdot \dot{Q}(t) \cdot \sin(\varphi(t)) \tag{33}$$

$$\ddot{Q}(t) = \frac{\mathrm{B_0} \cdot n \cdot A}{L} \cdot \dot{\varphi}(t) \cdot \sin(\varphi(t)) \tag{34}$$

At first the algorithm has to be verified. Therefore a torque-computation was checked with a constant electrical current in the coil. The rotation of the permanent magnet has been started with constant angular velocity, and the rotation was observed as a function of time (see fig.15). Obviously the angular velocity is modulated by the magnetic forces as expected.

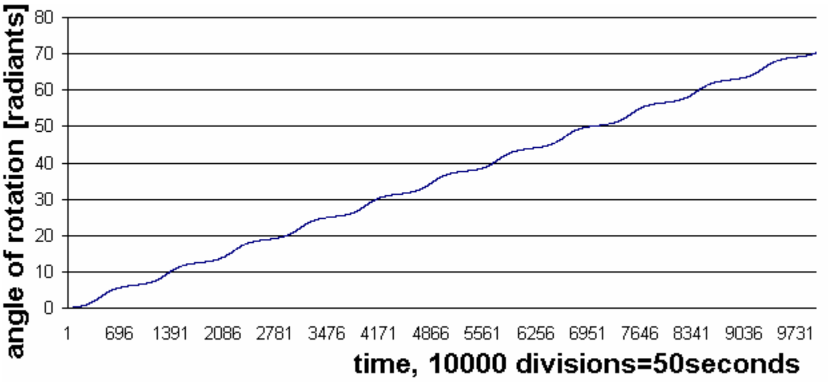

Figure 15: Display of the angle of the rotation, which shows the modulation of the angular velocity, due to the magnetic forces between the magnet and the coil.

By the way, the angular acceleration does not follow a sine shape, as can be seen in fig.16.

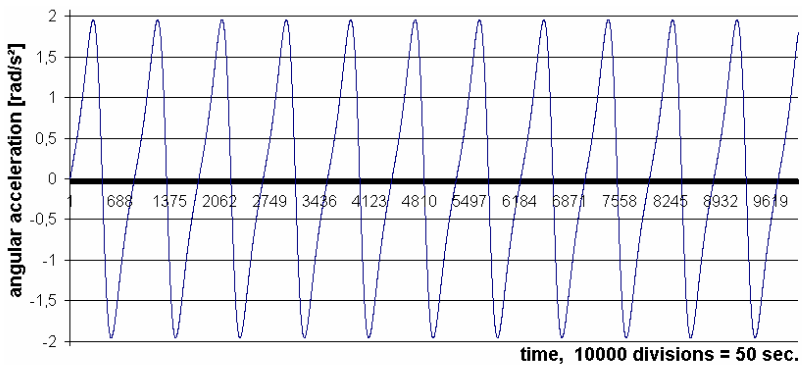

Figure 16: This is the angular acceleration, which leads the motion shown in fig.15.

If we start the rotation with a constant angular velocity, and allow the coil to take induced voltage, but also produce a magnetic field due to the induced current, we can find very different behaviour of the magnetic forces (as well as very different behaviour of the angle of rotation), depending on the choice of the system-parameters. An example therefore is shown in fig.17 (angle of rotation) and in fig.18 (electrical current in the coil). If we analyse the total energy of the system (with normal classical adjustment of the parameters), we find perfectly the conservation of classical energy, this is the energy-sum of the kinetic energy (of the rotation of the magnet), the electric energy in the coil and the electric energy in the capacitor, because the potential energy of the magnet in the coil is converted immediately into electrical energy going into the coil (and later also into the capacitor).

For the purpose of illustration: During the rotation of the magnet, a voltage is induced into the coil, which converts mechanical energy (in the rotation) into electrical energy in the LCR-circuit. But the Lorentz-forces convert electrical energy in the opposite way back from the LCR-circuit into energy of the mechanical rotation. This causes a rather complicated type of motion of the magnet, as can be seen in fig.17.

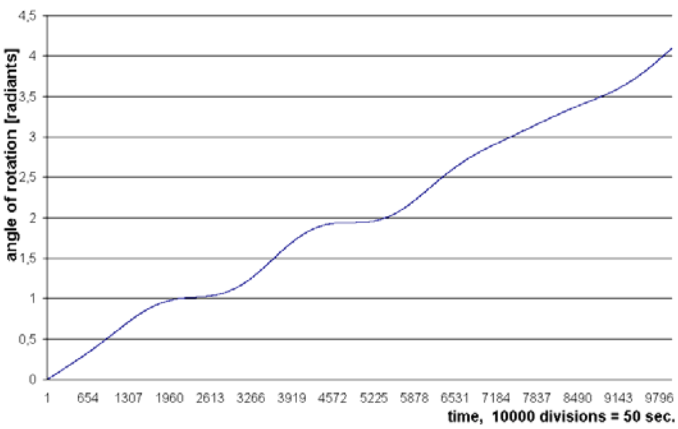

Figure 17: Angle of rotation of the magnet inside the coil.

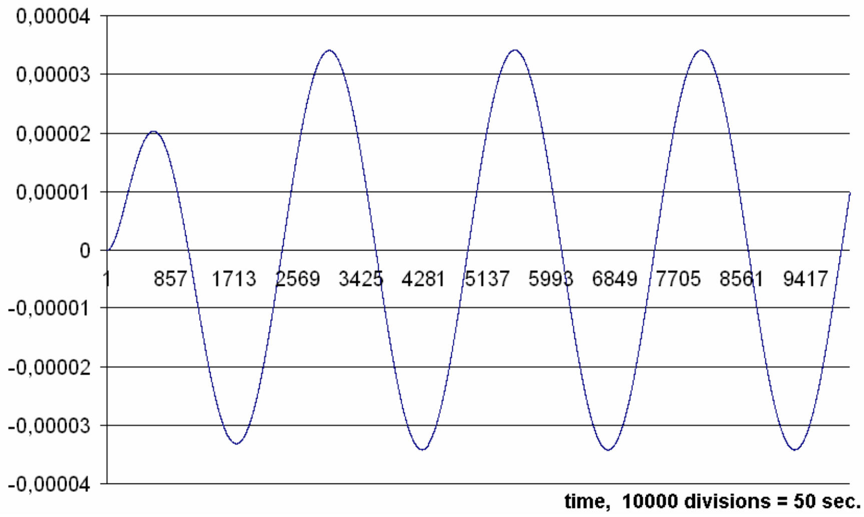

Figure 18: Electrical current (Amperes) in the coil, which is caused by induction due to the rotation of the magnet.

We now introduce the Ohm's resistance of the wire, from which the coil is made (and later additionally also some additional load resistance for the purpose of the extraction of energy from the system). By this means we come to the following test of verification:

We start the rotation with a constant angular velocity (as initial condition), but without any electrical charge or energy in the LCR-circuit. The rotation of the magnet induces a voltage into the coil, which then causes some energy-loss at the resistor. This absorbs some energy from the system as can be see in fig.19 (the kinetic energy of the rotation is decreasing as a function of time) and in fig.20 (the electric current in the coil is decreasing also as a function of time).

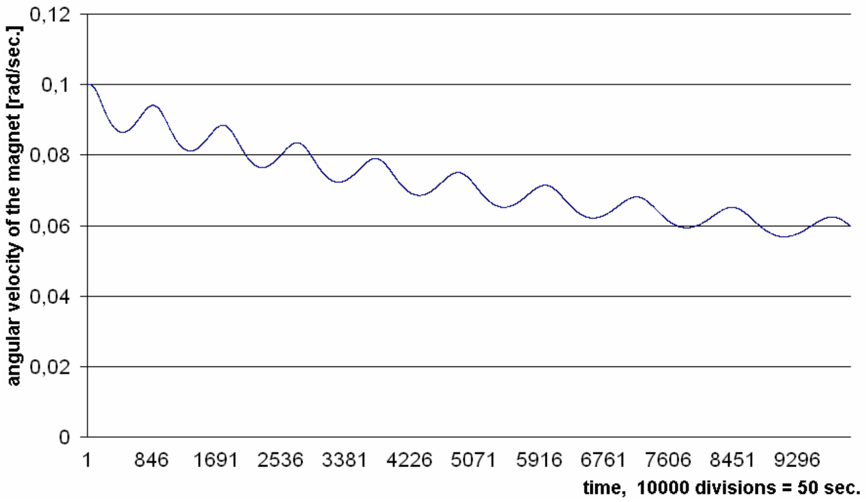

Figure 19: Angular velocity as a function of time.

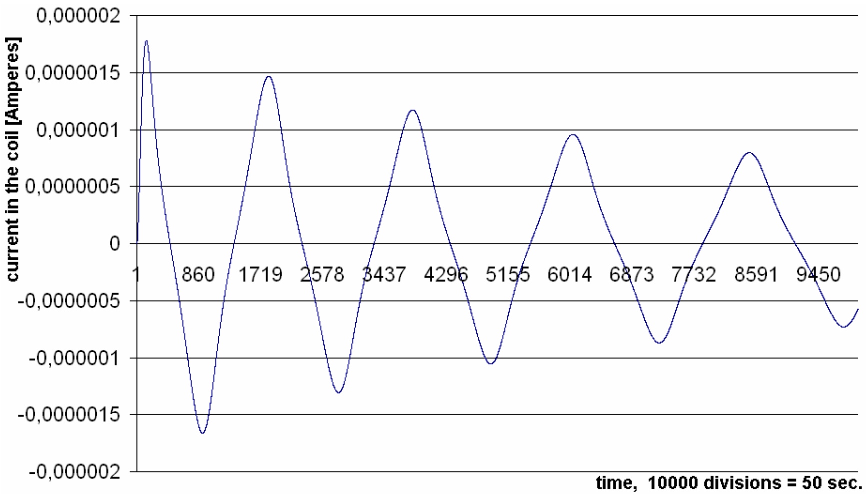

Figure 20: Electrical current in the coil as a function of time.

If we reduce the Ohm's resistance to zero (the wire of the coil as well as the load resistor), for the purpose of verification, we can verify the conservation of classical energy accurately: Fig.24 shows the total energy of the system as the sum of the coil's energy (fig.21), the capacitor's energy (fig.22) and the rotation-energy of the magnet (fig.23) [Bec 73] – as long as the system's parameters are not adjusted for the conversion of zero-point energy.

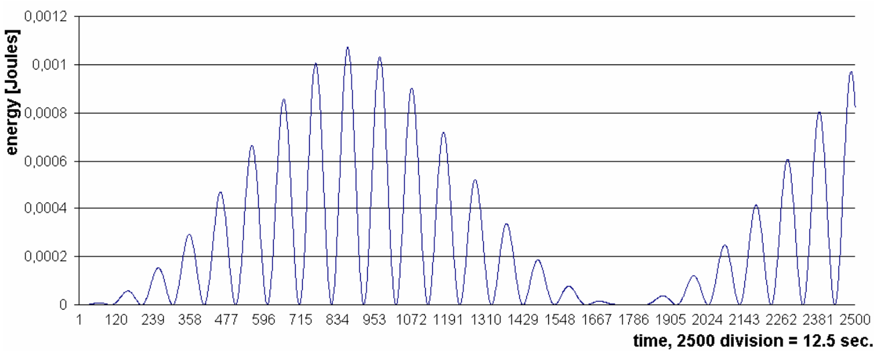

Figure 21:
Energy in the coil
$E_S = \frac{1}{2} L \cdot I^2$

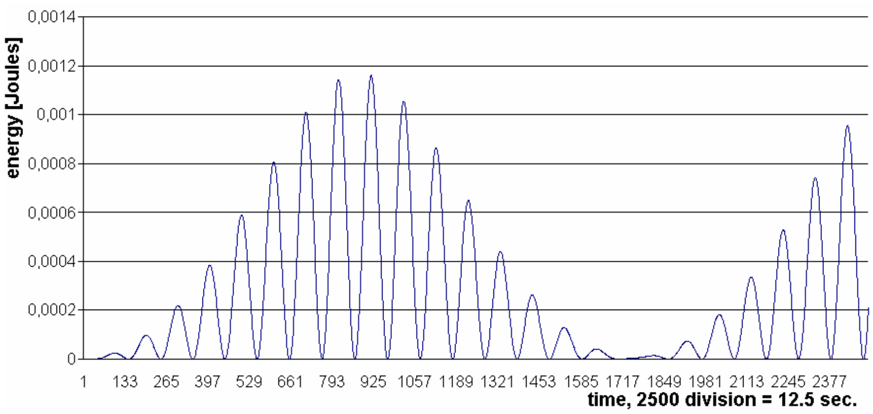

Figure 22:
Energy in the capacitor
$E_C = \frac{1}{2} C \cdot U^2$

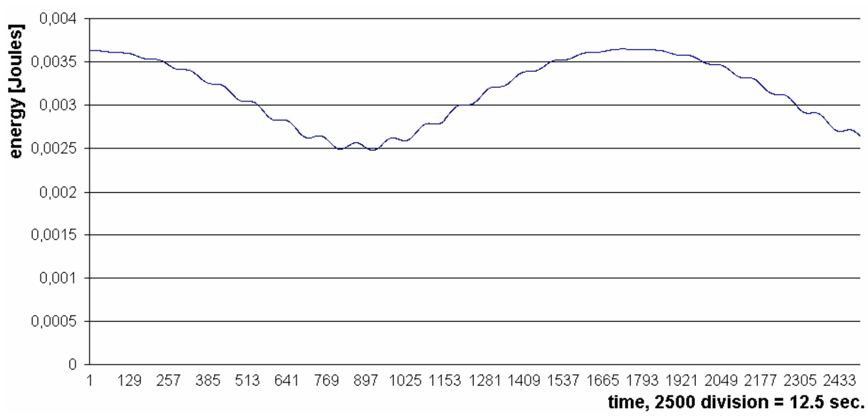

Figure 23:
Energy of rotation in the magnet
$E_R = \frac{1}{2} J \cdot \omega^2$

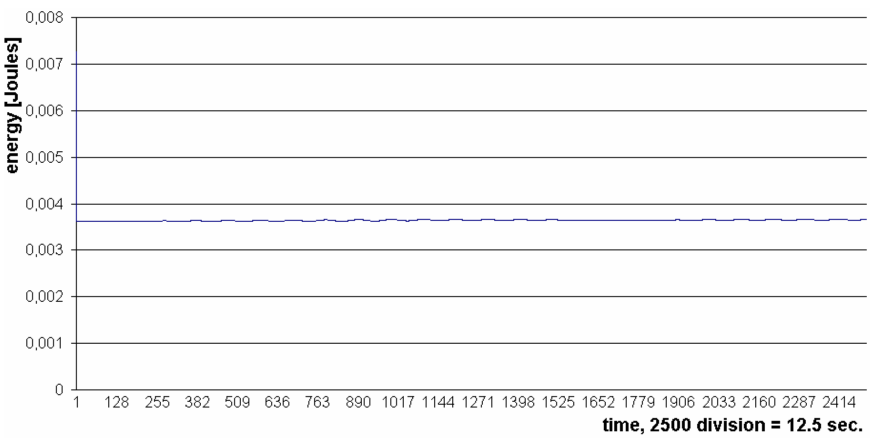

Figure 24:
Total energy-sum
$E_{Ges} = E_S + E_C + E_R$

Except for numerical noise, the total energy-sum is constant (when solving the differential equation without adjustment to zero-point-energy conversion).

We now begin the adjustment of the system parameters for the conversion of zero-point-energy. Therefore we have to align the resonance frequency of the electric LCR-oscillation-circuit with the frequency of rotation of the permanent magnet. But they can not be identical, because the power-extraction from the electric circuit acts like a damping of the oscillation-circuit, which de-tunes its characteristic resonance frequency.

We approach to the adjustment of the system parameters with all resistors being switched of (Ohm's resistor and load resistor both being zero). Then we start the rotation of the magnet with a well defined number of revolutions per minute. Under these conditions, we start to adjust the electric LCR-oscillation-circuit to the same frequency as the rotation of the magnet has. At the beginning, the electrical circuit did not contain any energy. When the adjustment of the electrical oscillation-circuit is close enough to the frequency of the initial rotation, we have a state of the system, which can be understood as the double-resonance of the electrical and the mechanical parts. In this state, the system begins to build up classical energy by alone, and the new classical energy is coming from the zero-point reservoir.

As soon as we have found this point of operation, we can slowly introduce the Ohm's resistance of the coil's wire, in tiny steps, step by step, into the differential equations. But we have to perform very small steps for the enhancement of this Ohm's resistance, and always to renew the adjustment the parameters of the electrical circuit (capacity, inductivity, number of coil's windings) step by step, in order not to lose the state of operation, in which zero-point energy is gained. This procedure has to be done very carefully; otherwise we would lose the information about the good operation of the system. Step by step we learn how to operate the system in a way, that the power-gain from the zero-point-energy is large enough to support the complete coil (with its whole Ohm's resistance) with power. Very carefully we give attention to the double-resonance in order not to lose it.

When this mode of operation is found, the rotor runs safe and reproducible with the system parameters we have found, to be a self-running engine. With these parameters, the motor can be started with a given initial number of revolutions per minute. Therefore it is started once by hand, and then the rotation continues by alone, being supplied from the zero-point energy of the quantum-vacuum. We now can measure the angular velocity of the rotor (see fig.25) und the electrical current in the coil (see fig.26). Now it is clear, that the total sum of the classical energy within the system is not constant, because the system is connected to the zero-point energy of the quantum-vacuum (fig.27).

By the way, it should be mentioned, that an improper adjustment of the system parameters can have the consequence, that classical energy is converted into zero-point energy of the quantum-vacuum. In this case, the engine has to be feeded with more classical mechanical energy, than the Ohm's resistances consume. This means, that under such operation, the total energy sum, including the Ohm's losses and the load is not constant, but decreasing during time. The lack of classical energy, which can not be explained from classical energy conservation, has its reason in the conversion of classical energy into some zero-point energy of the quantum-vacuum. This means that the machine can be used in both directions: As a converter of classical energy into zero-point energy as well as a converter of zero-point energy into classical energy.

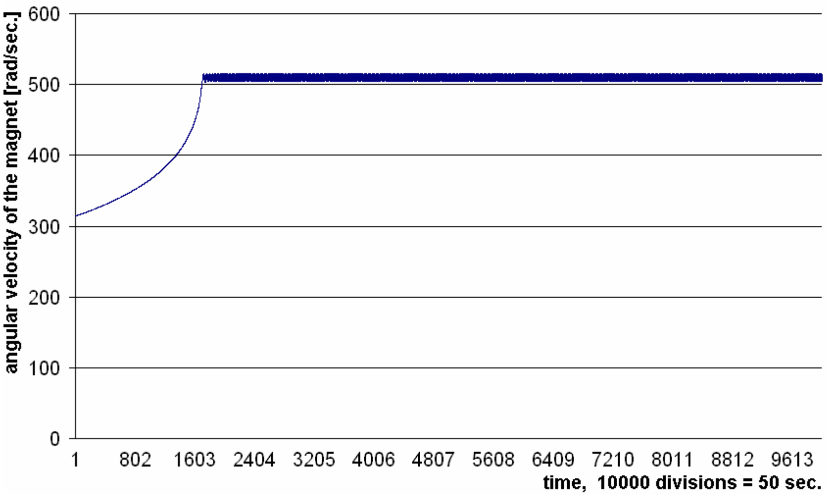

Figure 25:
Angular velocity of the rotation.

Due to the high revolution speed, the resolution of the graphics does not allow to see the single oscillations.

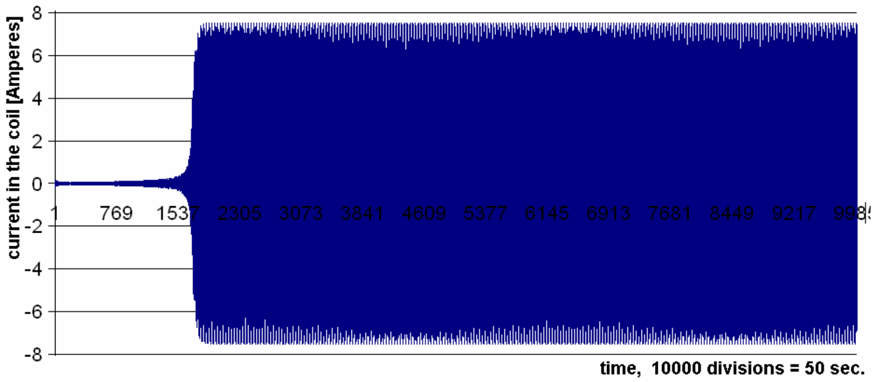

Figure 26:
Electrical current in the coil.

Due to the high revolution speed, the resolution of the graphics does not allow to see the single oscillations.

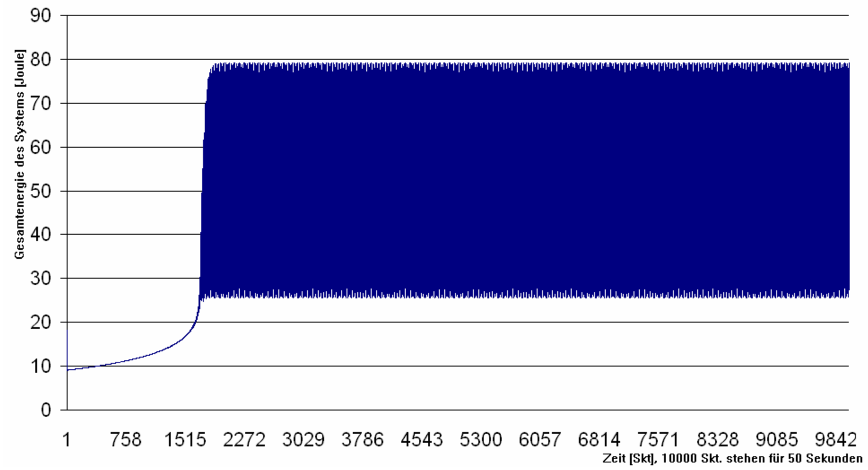

Figure 27:
Total energy-sum of the system.

Due to the high revolution speed, the resolution of the graphics does not allow to see the single oscillations.

Obviously, the system is started with a given angular velocity at the very beginning. From there on, it gains classical energy from the zero-point energy, which it converts completely into the energy of rotation. This is done until the angular velocity of the rotation reaches a certain value. The restriction to this value has its reason in the fact, that a further additional enhancement of the angular velocity would decrease the adjustment of the system parameters, with the consequence that from there on less zero-point energy could be converted. This point is reached at a time of about 1700 Skt. (see fig.25).

From this point on, where the mechanical energy due to the angular velocity must be constant, the energy gain from the zero-point energy is pumped into the electrical circuit, so that from time of about 1700 Skt. up to about 1900 Skt., the electrical oscillation gains energy (see fig.26).

Now both parts of the system are filled up with enough energy, so that the system itself can not take more energy inside than it already has. In this state, every enhancement of the amount of energy inside would decrease the adjustment of the parameters, so that energy will be given away, until the system comes back into its good state of operation. From there we see, that the system runs into a stable operation by alone, so that is not necessary to support trigger-pulses to control the operation. The system can now run (as long as nobody will stop or damage it) being supported by zero-point energy. This state of stable operation can be called as "**energetically saturated**".

We now want to introduce an additional load resistor (additional to the Ohm's resistance of the coil's wire) in order to extract energy from the system (see fig.28). This load resistor will extract permanently energy, which is the energy-output and power- output of the zero-point energy machine. In the differential equations, we have to introduce an additional load resistor in series with the Ohm's resistance of the coil's wire, see equation 35. The calculation of the extracted power is shown in equation 36.

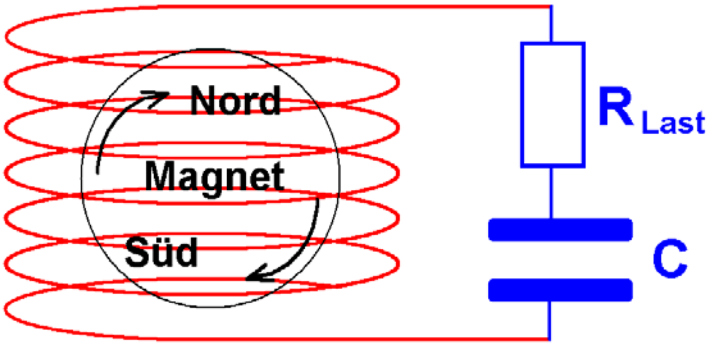

Figure 28:
This setup now shows the results of the present publication:
It is a powerful zero-point energy motor with realizable dimensions.

$$-L \cdot \ddot{Q}(t) + (R + RLast)\dot{Q}(t) + \frac{1}{C} \cdot Q(t) = 0 \qquad (35)$$

$$P_{Last} = U_{Last}\dot{Q} = R_{Last}\dot{Q}^2 \qquad (36)$$

The crucial point is, that the converter has to be driven in a state short below the „energetical saturation", so that the energy-gain from the zero-point energy is maximal. This state of operation can be found in theory quite well, because in theoretical calculations it is easily possible to control the behaviour of the system with very different values of the system parameters very efficiently and very exactly. Under this control it is possible to adjust the system parameters, such as the capacity, the inductivity, the number of windings, and so on… The parameters which have been found for good operation can be seen in the Source-code of the DFEM-algorithm in the appendix.

A practical experiment to build up such a zero-point-energy converter is only sensible on the basis of a well understood theory, from which we can learn how to adjust the system parameters. The adjustment of the system parameters appears difficult enough, that it is not very likely, that anybody might manage to find this adjustment without theoretical understanding: From theory we must learn how adjust the zero-point-energy converter, and in experiment we will have to build up, what we learned from theory.

As soon as the system is adjusted, the motor will run stable, as long as we do not try to extract more energy then the motor can deliver. (For more energy we should use a larger motor.) Our Motor has a diameter of 9 cm and a height of 6.8 cm – so this is not very much – and we will soon see that it produces a power of 1.07 Kilowatt. On the other hand, if the load is decreased, the power production will be decreased. This is a feature of the system, because the system never can overtake the state of "energetic saturation". This feature is a great advantage of the zero-point energy converter presented here, because it never can run away (as it is known from other systems reported in literature, see for instance [Har 10]). This makes our system safe in operation and avoids accidents.

Question: Can the power-density of 1.07 Kilowatts in a cylinder of 9 cm x 6.8 cm be enhanced even more ?

Answer: YES !

In reality the optimization of the system parameters can be developed much further, so that even such a small zero-point-energy converter as in our example could be brought into the Megawatt-range, because the energy- density of the zero-point-energy is tremendously large. But in the example shown here, the further optimization of the system parameters has been withdrawn in order to restrict the converted power to 1kW, because there we reach the limit of the strength of the material. The magnet rotates with 6000 rpm, which should not be a problem for a good commercial bearing, and the copper wire from which the coil is made has a cross section area of 1.0 mm^2 , which is not too much for an electric alternating current of I_{max} = 18 Ampere in the peak (the effective values are smaller of course). This is the reason, why I decided not to demonstrate even more power-density, because this would be not realizable due to the stability of the material.

Let us now have a look into few details of the DFEM-model of the zero-point energy motor:

The electrical current in the coil (see fig.29) is AC, same as in fig.26. But please have in mind, that the time scale in fig.29 is different from the time scale in fig.26, so that the oscillations can be seen now. Please notice, that the energy in the coil (see fig.32) must go back to zero within every revolution, because there has to be a moment in every turn of the magnet, during which the coil does not produce any magnetic field. This is necessary, because the magnetic field has to be switched on and off periodically, otherwise it would not be possible to convert zero-point energy. During each turn of the magnet, there are two moments in time, at which the coil produces a magnetic field, which accelerates the magnet. But there must be intermediate time-intervals between these field-moments, where the magnet has an orientation, that the field would decelerate its rotation. During this intermediate time-intervals, the electrical charge is stored in the capacitor, so that the coil has no current, so that the magnetic field is absent, so that the magnet is not decelerated. The fact that this procedure accelerates the magnet can be seen in fig.30, where the magnet become faster and faster (up to a certain point as stated above). This can be seen in fig.31 very clearly, when we look to the angular velocity. There we see, that the angular velocity is increasing until the motor finally comes into its "energetical saturation".

The fact that the angular velocity contains a small part of an oscillation is also clear, because the rotating magnet is accelerated twice per each turn, and in between there is a time-interval without acceleration. In the intermediate time-intervals between the acceleration, there is even some deceleration, because the flux of the electrical charges, which causes the acceleration needs some time to leave the coil and go into the capacitor. Nevertheless it is clear, that the system is optimized for energy-conversion from the zero-point energy, so that the acceleration and deceleration and the electrical AC-current are adjusted to each other. The result can be seen in fig.32, where we see the total energy-sum of the classical energy in the system. (The saturation is due to the extraction of energy by the load resistor.)

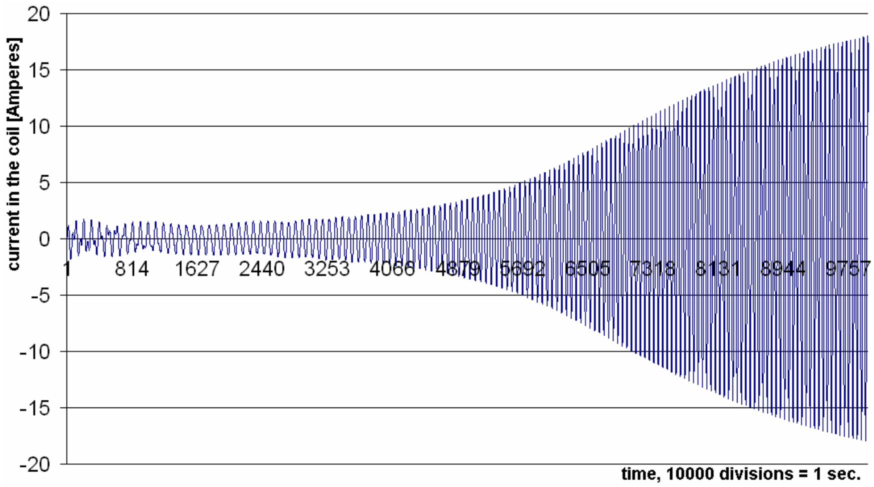

Figure 29: Electrical current in the coil

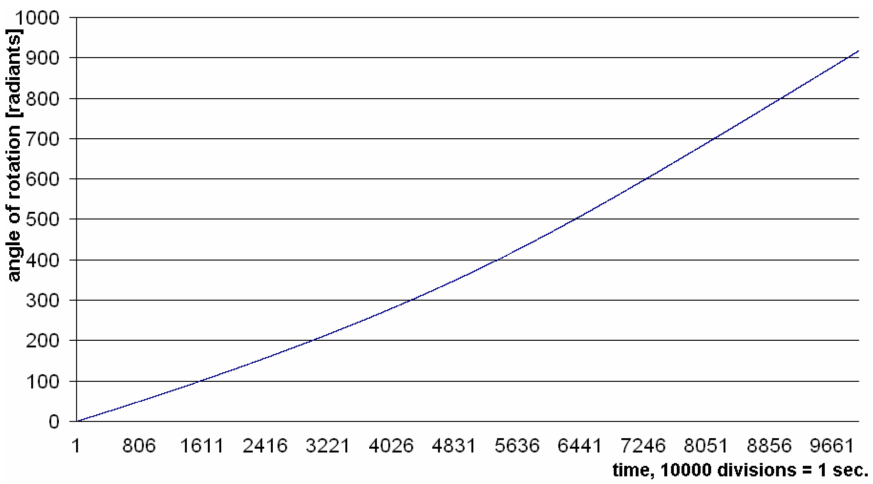

Figure 30: Angle of rotation

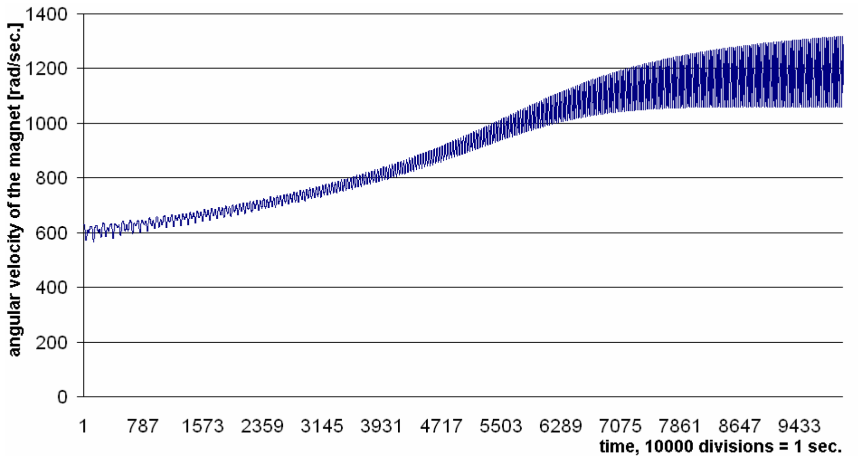

Figure 31:
Angular velocity

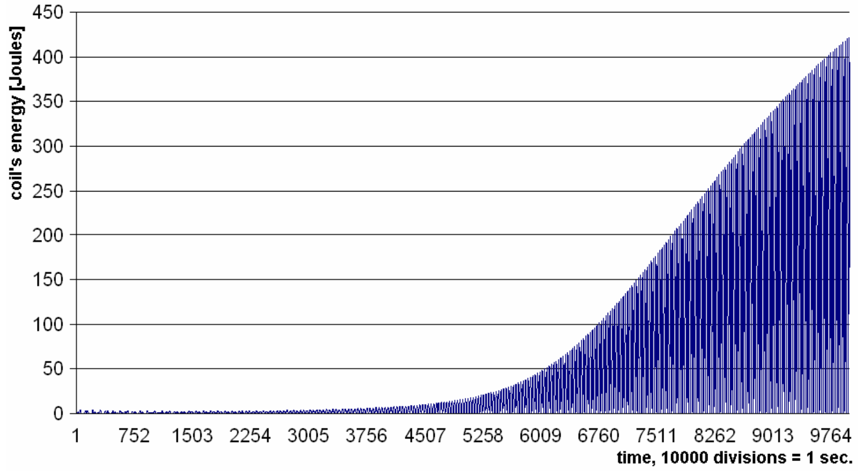

Figure 32:
Energy in the coil

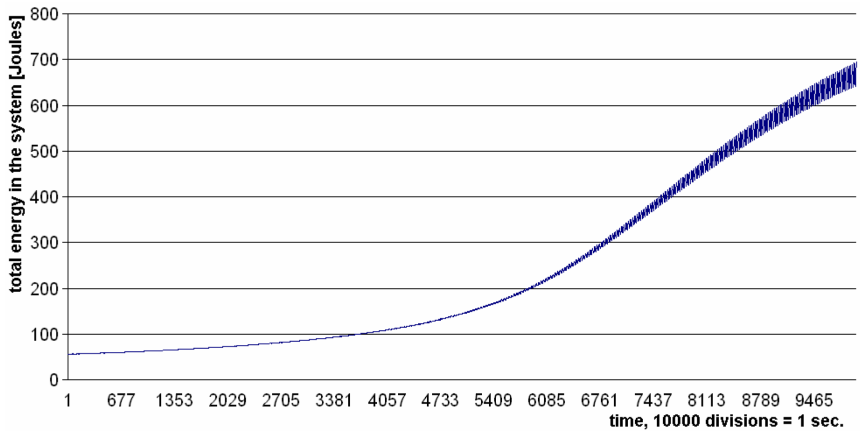

Figure 33:
Total energy-sum in the system.

For we have a listing of the 11 system parameters in the algorithm in the appendix, everybody can understand the presented example and optimize his or her own system and adjust it to the available materials. This means that the theoretical conception is developed far enough, that experimentalists are invited to verify the zero-point-energy converter system in the laboratory. Everybody is welcome to build up his or her own zero-point-energy motor.

7. Resumée

The result of the present work is, that the available theory not only explains the theoretical fundament of the conversion of zero-point-energy, but it also allows to construct a machine with practicable dimensions and powerful operation. It is a self-running zero-point-energy motor in the Kilowatt-range, which is now theoretically understood. On this basis it should be possible to develop a practical setup.

Different from practical experiments reported in literature, this is the first complete theory and a basic understanding of zero-point-energy motors. This arises hope for a reproducible practical machine.

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Claus W. Turtur, PHILICA.COM, ISSN 1751-3030, Article number 213, (7. Dez. 2010)

9. Appendix: Sorce-Code of the DFEM-algorithm

```
Program Magnetic_converter_with_power_extraction;
{$APPTYPE CONSOLE}
uses
  Windows, Messages, SysUtils, Classes, Graphics, Controls, Forms, Dialogs;

Const AnzPmax=10000;   {number of time-steps to solve the differential equation}

Type Feld = Array[0..AnzPmax] of Double;

Var epo,muo    : Double;   {constants of nature}
    lichtgesch : Double;   {speed of light}
    n          : LongInt;  {number of windings in the coil}
    A          : Double;   {cross section area of the coil}
    Bo         : Double;   {magnetic field (Amplitude) of the permanent magnet}
    ls         : Double;   {length of the cylindrical coil}
    di         : Double;   {diameter of the coil body}
    Dd         : Double;   {diameter of the wire}
    rm         : Double;   {Radius of the permanent magnet }
    L          : Double;   {Inductivity of the coil}
    C          : Double;   {capacity of the capacitor}
    R          : Double;   {Ohm`s resistance of coil's wire }
    rho        : Double;   {Specific resistance of copper}
```

```
    phi,phip,phipp : Feld; {angle and its derivatives}
    Q,Qp,Qpp       : Feld; {electrical charge and its derivatives}
    i          : LongInt;  {counter}
    AnzP       : LongInt;  {number of the time-steps in computation}
    dt         : Double;   {duration of the time-steps in computation}
    Abstd      : Integer;  {plot-interval}
    omo        : Double;   {characteristic frequency of the electric oscillation-circuit}
    T          : Double;   {duration per oscillation of the electric oscillation-circuit}
    UC,UL      : Double;   {voltage at capacitor and coil}
    rhom       : Double;   {density of the magnet-material}
    dm         : Double;   {thickness of the cylindrical magnet}
    mt         : Double;   {mass of the cylindrical magnet}
    J          : Double;   {moment of inertia of the cylindrical magnet}
    K0,K1,K2,K3,K4,K5 : Feld;  {control-arrays for display }
    EmA,EmE,siA,siE : Double;  {Energy: average and Sigma "beginning" and "End"}
    delE,sigdelE    : Double;  {alteration of  the averages}
    UmAn            : Double;  {Start value: rounds per time at the beginning}
    Eent            : Double;  {extracted energy, elektrically}
    Rlast           : Double;  {Ohm's resistance for load}

Procedure Wait;
Var Ki : Char;
begin
  Write('<W>'); Read(Ki); Write(Ki);
  If Ki='e' then Halt;
end;

Procedure ExcelAusgabe(Name:String;Spalten:Integer;KA,KB,KC,KD,KE,KF,KG,KH,KI,KJ,KK,KL:Feld);
Var fout   : Text;    {Up to 12 columns can be written}
    lv,j,k : Integer; {counter}
    Zahl   : String;  {to be printed to Excel}
begin
  Assign(fout,Name); Rewrite(fout);       {open File}
  For lv:=0 to AnzP do       {from "plotanf" to "plotend"}
  begin
    If (lv mod Abstd)=0 then
    begin
      For j:=1 to Spalten do
      begin   {Kolumnen drucken}
        If j=1  then Str(KA[lv]:19:14,Zahl);
        If j=2  then Str(KB[lv]:19:14,Zahl);
        If j=3  then Str(KC[lv]:19:14,Zahl);
        If j=4  then Str(KD[lv]:19:14,Zahl);
        If j=5  then Str(KE[lv]:19:14,Zahl);
        If j=6  then Str(KF[lv]:19:14,Zahl);
        If j=7  then Str(KG[lv]:19:14,Zahl);
        If j=8  then Str(KH[lv]:19:14,Zahl);
        If j=9  then Str(KI[lv]:19:14,Zahl);
        If j=10 then Str(KJ[lv]:19:14,Zahl);
        If j=11 then Str(KK[lv]:19:14,Zahl);
        If j=12 then Str(KL[lv]:19:14,Zahl);
        For k:=1 to Length(Zahl) do
        begin   {use commata, not decimal points }
          If Zahl[k]<>'.' then write(fout,Zahl[k]);
          If Zahl[k]='.' then write(fout,',');
        end;
        Write(fout,chr(9));  {Data separation, Tabulator}
      end;
      Writeln(fout,'');    {line-feed}
    end;
  end;
  Close(fout);
end;


Begin {main program}
{ Initialisierung - Vorgabe der Werte: }        {we use SI-units}
  Writeln(vacuum-energy-converter with rotation.');
{ Input-Parameters:}
  epo:=8.854187817E-12{As/Vm}; {Magnetic constant}
  muo:=4*pi*1E-7{Vs/Am};       {Elektric constant}
  lichtgesch:=Sqrt(1/muo/epo){m/s};   Writeln(speed of light c = ',lichtgesch, ' m/s');
{ coil, magnet, capacitor:}
  n:=1600;     {number of windings in the coil}
  di:=0.09;    {diameter of the coil body}
  Dd:=0.0010;  {diameter of the wire}
  Bo:=0.700;   {Tesla} {Magnetic field (Amplitude) of the permanent magnet}
  ls:=0.01;    {Meter} {length of the cylindrical coil}
```

```
  C:=0.23E-6;  {Farad} {capacity of the capacitor}
  rm:=0.039;   {Meter} {Radius of the cylindrical permanent magnet}
  dm:=0.01;    {Meter} {thickness of the cylindrical permanent magnet}
  rhom:=7.8E3;         {density of the magnet-material, iron}
{ composed Parameters, calculated from the above Parameters:}
  A:=di*di; {Meter * Meter} {cross section area of the coil}
  L:=muo*a*n*n/ls;  {Inductivity of the coil}
  omo:=1/Sqrt(L*C); {characteristic frequency of the electric oscillation-circuit}
  T:=2*pi/omo;      {duration per oscillation of the electric oscillation-circuit}
  rho:=1.7E-8; {Ohm*m}  {Specific resistance of the copper wire}
  R:=rho*(2*pi*di*n)/(pi*(Dd/2)*(Dd/2)); {Ohm} {Ohm`s resistance of the coil's wire}
{ Sonstige:}
  UmAn:=100;              {Start value: revolutions per second at the beginning}
  Rlast:=28;              {Ohm`s resistance for load}
  AnzP:=AnzPmax;          {number of the time-steps in computation}
  dt:=0.0001; {sec.}      {duration of the time-steps in computation}
  Abstd:=1;               {how many points to be plotted}
  mt:=pi*rm*rm*dm*rhom;   {mass of the cylindrical magnet}
  J:=1/2*mt*rm*rm;        {moment of inertia of the cylindrical magnet}
{ Anzeige der Werte:}
  Writeln('Inductivity of the coil: L = ',L,' Henry');
  Writeln('Freqency of the harmon.el.Osc.: omo = ',omo:8:4,' Hz => T = ',T:15,'sec.');
  Writeln('length of the coil-wire: ',(2*pi*di*n),' m');
  Writeln('Ohm`s resistance of the coil-wire: R = ',R:8:2,' Ohm');
  Writeln('Mass of the cylindrical permanent magnet: mt = ',mt,' kg');
  Writeln('moment of inertia of the cylindrical magnet: J = ',J,' kg*m^2');
  Writeln('total duration of operation: ',AnzP*dt,' sec.');

{ Begin of the computation.}
  Writeln('Mechaniacl and electrical linked oscillation.');
  UC:=0;{Volt}  Q[0]:=C*UC;         Qpp[0]:=0;  Qp[0]:=0; {Electrical initial values}
  phi[0]:=0;    phip[0]:=UmAn*2*pi;  phipp[0]:=0;          {Mechanical initial values }
  Eent:=0;                              {Reset for: extracted Energy, electrically}
  K0[0]:=0;
  K1[0]:=1/2*L*Sqrt(Qp[0]);  {coil-Energy}
  K2[0]:=1/2*C*Sqr(Q[0]/C);  {capacitor- Energy}
  K3[0]:=1/2*J*Sqr(phip[0]); {Rotation-Energy}
  K4[0]:=K1[0]+K2[0]+K3[0];  {total-Energy}
  K5[0]:=0;
  For i:=1 to AnzP do
  begin
    Qpp[i]:=-1/L/C*Q[i-1]-(R+Rlast)/2/L*Qp[i-1];
    Qpp[i]:=Qpp[i]+n*Bo*A*sin(phi[i-1])*phip[i-1]/L; {Induced voltage into the coil.}
    Qp[i]:=Qp[i-1]+(Qpp[i]-R/2/L*Qp[i-1])*dt;
    Q[i]:=Q[i-1]+Qp[i]*dt;
    phipp[i]:=-Bo*n*Qp[i]*A/J*sin(phi[i-1]); {Mechanical torque, x-component}
    phip[i]:=phip[i-1]+phipp[i]*dt;
    phi[i]:=phi[i-1]+phip[i]*dt;
    K0[i]:=0;
    K1[i]:=1/2*L*Sqr(Qp[i]);   {coil-Energy}
    K2[i]:=1/2*C*Sqr(Q[i]/C);  {Kondensator-Energie}
    K3[i]:=1/2*J*Sqr(phip[i]); {capacitor-Energy}
    K4[i]:=K1[i]+K2[i]+K3[i];  {total-Energy}
    K5[i]:=Rlast*Sqr(Qp[i]);   {extracted power at the load resistor}
    Eent:=Eent+K5[i]*dt;       {extracted energy at the load resistor}
  end;
{ total-Energy-balance and display of the results:}
  EmA:=0; EmE:=0; siA:=0; siE:=0;
  For i:=1 to 10 do  EmA:=EmA+K4[i]/10;              {average at the beginning}
  For i:=AnzP-9 to AnzP do EmE:=EmE+K4[i]/10;        {average at the End}
  For i:=1 to 10 do siA:=siA+Sqr(EmA-K4[i]);         {Variance at the beginning}
  For i:=AnzP-9 to AnzP do siE:=siE+Sqr(EmE-K4[i]);  {Variance at the End}
  siA:=Sqrt(siA)/10;  siE:=Sqrt(siE)/10;             {root mean square deviation}
  Writeln('Energy-values:  E_begin = (',EmA:11:7,' +/- ',siA:11:7,') Joules');
  Writeln('                E_End   = (',EmE:11:7,' +/- ',siE:11:7,') Joules');
  delE:=EmE-EmA;  sigdelE:=Sqrt(Sqr(siE)+Sqr(siA));
  Writeln('=> alteration:  delta_E = (',delE:11:7,' +/- ',sigdelE:11:7,') Joule');
  Writeln('=> converted power = (',delE/(AnzP*dt):11:7,' +/- ',sigdelE/(AnzP*dt):11:7,')
Watts');
  Writeln('extracted power at the load resistor =  ',Eent/(AnzP*dt):11:7,' Watts');
  ExcelAusgabe('test_04.dat',12,Q,Qp,Qpp,phi,phip,phipp,K0,K1,K2,K3,K4,K5);
  Wait;   Wait;
End.
```