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Centrifugal Force Engine

Igor Mihajlovich Aladyn

Joint Stock Company "Concern "Sozvezdie", Plehanovskaj Street,
14, 394018, Voronezh, Russian Federation

Abstract: This article contains a theory which allows solving the issue of motion being unsupported by the external environment. The theory has arisen from the Radiophysical Research and Development concerning the "Quadrature Modulation and Demodulation of Frequency Modulated Signals". When investigating the properties of the quadrature mapping the FM-signals it has been found out that the even quadrature of a signal becomes the unipolar one at the zero intermediate frequency and the modulation index less than **pi/2**. This property complicates the real demodulation circuitry, but in the field of the theoretical mechanics it allows solving the issue of motion being unsupported by the external environment. The further information is set forth below. There's also a link to the video with the experiment, which confirms the theory.

Key words: Theory · Motion · Unsupported · Centrifugal · Force · Evenness

INTRODUCTION

The solution of the problem concerning the motion being unsupported by the external environment has been seeking for about 80 years. The obvious solution candidate of such problem is the centrifugal force, as there is no need in the external environmental for it to occur [1-4]. But in this field the search has been suspended. It is partly because some experts view the centrifugal force as the mathematical abstraction only [5].

The contradiction between such attitude and [1-8] seems to be especially strange, as the centrifugal force engines developed by V.N. Tolchin, R. Cook, G.I. Shipov and A. Thornson operate steadily enough.

G.I. Shipov supposes that a paradoxical situation has arisen for the lack of the convincing engine theory [9].

As it is known he theory seems to be convincing when it is based on the well-known forces and laws. The proposed theory is based on the centrifugal force and the proof of its ability to move loads being unsupported by the external environment follows from the universally recognized law of nature "**Cos±x = Cosx**". The experimental test of the theory has confirmed this ability of the centrifugal force. In addition, the conditions of the unsupported motion stability and the high efficiency achievement have been successfully defined.

Centrifugal Force Engine Theory: The primitive engine is a rotary bar with a flyweight at its end, as on the Figure 1. The centrifugal force vector $\mathbf{R_0}$ acts on the flyweight. Its direction is determined by the angle **g**, its value is defined by $\mathbf{R_0 = mrW^2 = mV^2/r}$, here **m** – is the flyweight mass, **r** – is the bar length, **W = dg/dt** – is the spin rate, **V –** is the linear rate. The $\mathbf{R_0}$ vector projections on «**x**» and «**y**» axises (quadratures) are defined as $\mathbf{R_x}$ and $\mathbf{R_y}$ respectively. When **W = const**:

$$\mathbf{R_x = R_0\ SinWt} \tag{1}$$
$$\mathbf{R_y = R_0\ CosWt}.$$

i.e. in this case the quadratures are the alternating quantities.

$$\mathbf{-R_0 \le R_x \le +R_0}.$$
$$\mathbf{-R_0 \le R_y \le +R_0}.$$

If the rotation axis is fixed on a platform which could move freely in any direction, then under the influence of such quadratures the motion in the closed path will start, as on the Fig. 2b. Could such a path be broken?

Obviously, yes, if there is a possibility to ensure the sign constancy, at least for one of the quadratures. For example, if $\mathbf{R_y}$ always maintains the «+» sign, then the

Corresponding Author: Aladyn, Joint Stock Company "Concern "Sozvezdie", Plehanovskaj Street, 14, 394018, Voronezh, Russian Federation.

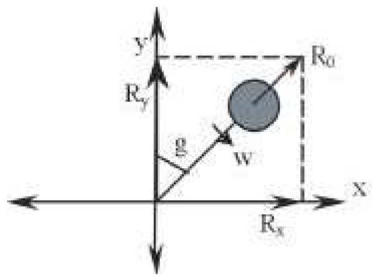

Fig. 1: Primitive Engine

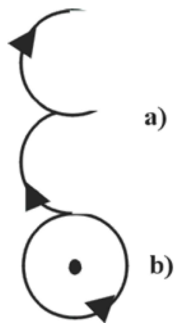

Fig. 2: Motion Path

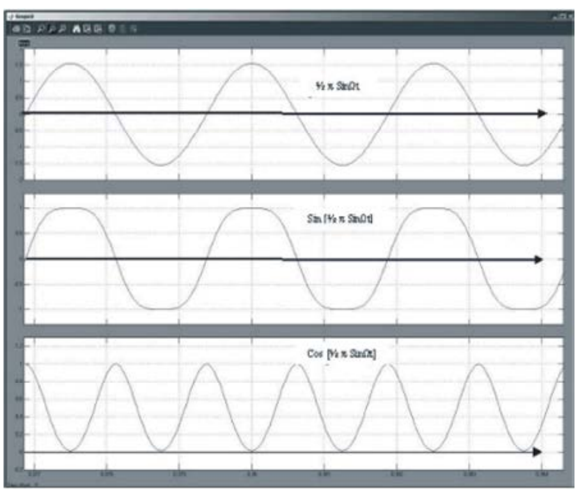

Fig. 3: Modelling Result

resultant thrust vector $\mathbf{R_0}$ which is relevant to this case will oscillate in the range of 0 – 180°, i.e. within two upper quadrants. Under the influence of the thrust vector the motion path could not have sections in the opposite direction; therefore, it could only be a sequence of semicircles as on Fig. 2a. Could the quadrature sign constancy be ensured? The mathematics allows doing it only for the quadrature $\mathbf{R_y}$, as it is the only quadrature defined by the even function **Cos[±x(t)] = Cos[x(t)].** In addition, all the **x(t)** values should be limited by the ±**pi/2** interval to maintain the sign**.** The required primitive function is as follows:

$$\mathbf{x(t) = ½pi\ Sinwt} \quad (2)$$

Then the required rotation should be defined using the following equations:

$$\mathbf{R_x = R_0\ Sin\ [½\ pi\ Sinwt]} \quad (3)$$
$$\mathbf{R_y = R_0\ Cos\ [½\ pi\ Sinwt]}.$$

The Fig.3 shows the result of the equation modelling (3) in MATLAB, which illustrates at any **x(t)**:

$$\mathbf{– R_0 \le R_x \le + R_0}$$
$$\mathbf{0 \le R_y \le + R_0}$$

The physical significance of the equations (3) is well interpreted by the radiophysics. Here the signal in the form of $\mathbf{u(t) = U_0 SinW_0 t}$ is usually mapped by the rotation vector $\mathbf{U_0}$. At the constant amplitude and frequency of **u(t)**, the $\mathbf{U_0}$ vector quadratures are seen the same as those of $\mathbf{R_0}$. But if the **u(t)** frequency is modulated, then the $\mathbf{U_0}$ vector quadratures will be seen as follows:

$$\mathbf{U_x = U_0\ Sin\ (W_0\ t + k\ Sinwt + Y_0)} \quad (4)$$
$$\mathbf{U_y = U_0\ Cos\ (W_0 t + k\ Sinwt + Y_0)}.$$

Here $\mathbf{Y_0}$ **–** is the initial phase; $\mathbf{W_0}$, **-** is the central or intermediate frequency (IF) of the carrier wave; $\mathbf{k = \Delta W/w}$ – is the modulation index; $\mathbf{\Delta W = W_{max} – W_0}$ is the deviation, i.e. the maximum deviation from $\mathbf{W_0}$; **w** - is the modulation frequency [10].

The (3) and (4) equations become similar when:

$$\mathbf{W_0 = 0, k = ½\ pi, Y_0 = 0} \quad (5)$$

Therefore, the equation (3) describes the required flyweight rotation as the frequency modulated one, i.e. as the rotation of the ever changing spin rate. At the zero IF $\mathbf{(W_0 = 0)}$ the whole cycle **T** of the bar rotation should include two phases:

1-st phase – is the rotation of spin rate, which during **T\2** increases from zero to the maximum value $\mathbf{W_{max}}$ (acceleration).

2-nd phase – is the rotation of spin rate, which during **T\2** decreases from $\mathbf{W_{max}}$ to zero (braking).

When $\mathbf{W_0 = 0}$ the frequency deviation becomes equal to $\mathbf{\Delta W = W_{max} – W_0 = W_{max}}$.

The permanent motion will obviously take place, if the whole cycle is repeated at a certain frequency **w = 2pi/T.** Considering this the stable motion in the open path is as follows:

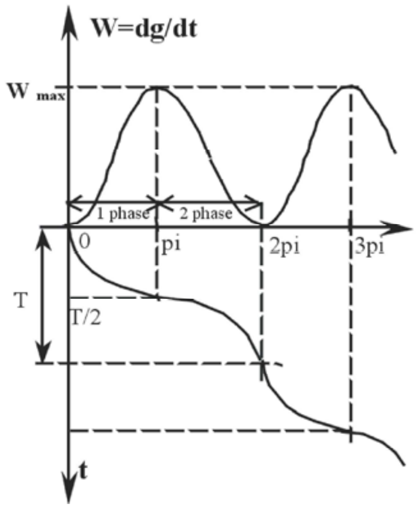

Fig. 4: Law of Rotational Motion

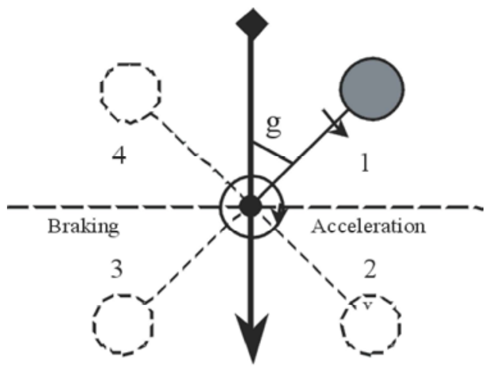

Fig. 5: Order of Rotation

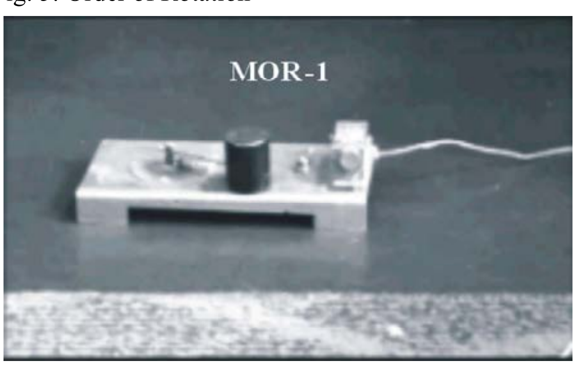

Fig. 6: Photo of the Laboratory Engine Model

$$\mathbf{Y_0 = 0;\ W_0 = 0;\ k = W_{max} / w = ½\ pi.} \quad (5a)$$

The Fig. 4 represents the qualitative mapping of the required Law of Rotational Motion and the Figure 5 represents the physical rotation map, which 1 and 2 quarters demonstrate the accelerating rotation and which 3 and 4 ones demonstrate the braking rotation.

Fig. 7: Motion Path when k > pi\2

This equation interpretation (3) has been carried out using the laboratory model on the Fig. 6. It has been established, that when $\mathbf{W_0}$ **= const** under the influence of the centrifugal force $\mathbf{R_0}$ the model is moved in the closed path, as shown on the Fig.2b and at the frequency modulated rotation the path is broken and looks just the same as on the Fig.2a (the video with the experiment is at the address: www.yadi.sk/d/38hodKAwFUhHR).

Thus, the model on the Figure 6 has confirmed the ability of the centrifugal force to move loads not only in the closed, but also in open path. As the nature of this force does not require the external environment, then the model motion could be ***unsupported by the external environment***.

For the model on the Fig.6 the **k** and $\mathbf{W_0}$ parameters of the Law of Rotational Motion could be regulated. In case of the small deviations from the required Law of Rotational Motion when the modulation index **k** becomes more than **pi/2,** there occur the loops in the motion path, as shown on the Fig. 7. At such modulation index values the quadrature $\mathbf{R_y}$ takes on the negative values, as the result of this the resultant thrust vector $\mathbf{R_0}$ shortly oscillates in the opposite direction, what generates the small loops in the motion path.

In case of the large deviations from the required Law of Rotational Motion, when $\mathbf{W_0 \neq 0}$, i.e. when at the points «**2pi*n**» on the Fig.4 the spin rate does not reduce to zero, the model totally loses stability in the motion direction. It could move frontwards, backwards, rightwards, leftwards. The case is that when $\mathbf{W_0 \neq 0}$ in the equations (3) the ever growing quantity **"$\mathbf{W_0t}$"** occurs. In the aggregate with **"½pi*Sinwt"** it generates totally positive, or totally negative or combined values $\mathbf{R_y}$. In such circumstances, the resultant thrust vector $\mathbf{R_0}$ could take any direction, what results in the regular and continuous shifts of the model motion direction.

The ideal model motion path (Fig.2a) resembles the form of the full-wave AC rectifier output voltage. In this case, the centrifugal force engine under consideration is called the Mechanical Oscillation Rectifier (MOR). The primitive MOR with a flyweight on the Fig.6 is called MOR-1.

Any engine is a converter of one energy form into another. MOR-1 directly converts the electric energy into the model kinetic energy. This fact guarantees him higher efficiency than those of the modern engines, as all of them operate being supported by the external environment and it inevitably causes the additional energy loss.

CONCLUSION

The MOR-1 centrifugal force engine on the Fig.6 could be seen as the proof of the theory trueness. A set of theoretical and process tasks are to be solved to organize the manufacturing of the real means of transport. Let's specify the most important of them.

It is necessary to:

- linearise the motion path
- Make the thrust vector $\mathbf{R}_0$ constant in the direction and value
- Eliminate the horizontal oscillations of the mass centre
- Solve the issues concerning the stability of the required Law of Rotational Motion
- Develop the MOR range for various energy sources

The alternate solutions of these problems will be considered in the further articles. It is reasonable to expect the efficiency of more than 70%.

Findings: The absence of need for being supported by the external environment allows manufacturing the conceptually new means of transport. They will possess the unique operational characteristics. For example:

- The ground means of transport will be able to move with high efficiency even under the icing conditions, in the context of the swampy and sandy areas
- The subsea MOR- driven means of transport will not require the propeller what allows them to submerge far deeper.
- The air and space means of transport will use the fuel more efficiently.

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