# Naturally Synthesized Polar Waves and Logic Puzzles

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Abstract: This paper first introduces a set of devices and methods for synthesizing polar waves, using a special magnetic circuit hidden pole motor to produce two stable fundamental waves, one is similar to harmonics, the other is polar waves with great difference in positive and negative amplitudes, which are natural synthetic waves, non-electronic tuning, different topologies have different phases and shapes. Using a pair of coils with opposite winding directions can make the motor output these two fundamental waves and their inverse waves at the same time. By selecting different wiring methods, four conjugated electromotive forces can be synthesized and exist at the same time, that is, the change of topology is like a logical operation, which can cause the observation results to become multiple equivalent images. If the motor has a pair of mirrored windings and is short-circuited to one of them, then even if the topology is no longer changed, only the direction of motion is changed, the output waveform of the motor in the reciprocal direction will also be significantly different, it does not have formal symmetry: one direction is the same amplitude, the opposite direction is the polar wave with a huge difference between the positive and negative amplitudes, and this difference increases with the increase of the number of turns of the two sets of coils. This means that the observation of natural results may also be affected by logical selection.

Keywords : synthetic wave ; logic operation ; topological structure ; polar wave ; Formal equivalence destruction; multimode oscillation ; reactive power.

# 0 background introduction

I invented a non-salient pole motor made of the spatial distribution difference of magnetic field density [ 1 ] [ 2 ].In the debugging process, it was found that the coils between the different magnetic poles would produce non-harmonic waves with huge positive and negative amplitude differences. This wave is stable and independent, and cannot be filtered and purified. The polarity can be tested by oscilloscope and diode, and the positive and negative terminals must be distinguished. The experiment also found that after adding a set of mirror windings to the motor, the output waveforms in the reciprocal direction are completely different. This paper will report the content and results of the experiment, hoping to study the physical mechanism behind it with the majority of researchers.

# 1 Independent coil experiment

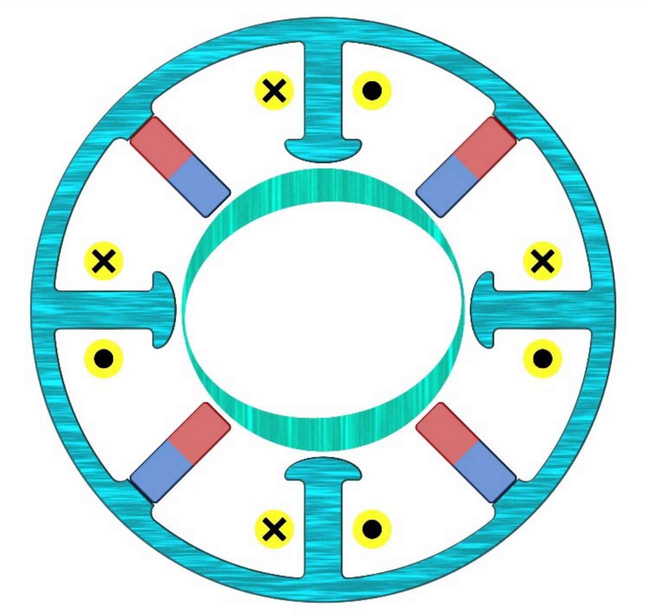

*Fig.1 Schematic diagram of motor principle*

Fig.1 is the schematic diagram of the motor principle based on the experiment in this paper : the magnet is fixed on the yoke, and a pair of magnets with the same polarity are arranged in turn to the opposite pair. There is a yoke convex column between the adjacent magnets, and the winding coil on the convex column is used as the armature. The armature coil winding is a pair of the same winding direction and then reversely twines another pair. The hidden pole structure completely composed of soft magnetic materials can move relative to the yoke, magnet and armature, its smooth surface is facing the magnet and armature, and the back of the bow is periodically raised. The repetition scale is equal to the distance between different magnetic pole groups, and the thinnest part can be interrupted, the thickest part should be wide enough to completely short the adjacent magnetic poles.

The motor is universal for motors and generators. It is a single-phase synchronous induction motor [3]. It is developed as a linear motor. The soft magnetic non-salient pole structure can be well extended to long rail laying. The best example is that two motors with the same magnetic sequence and opposite windings are connected in parallel, which can well balance the lateral pressure and suppress the back electromotive force pollution.

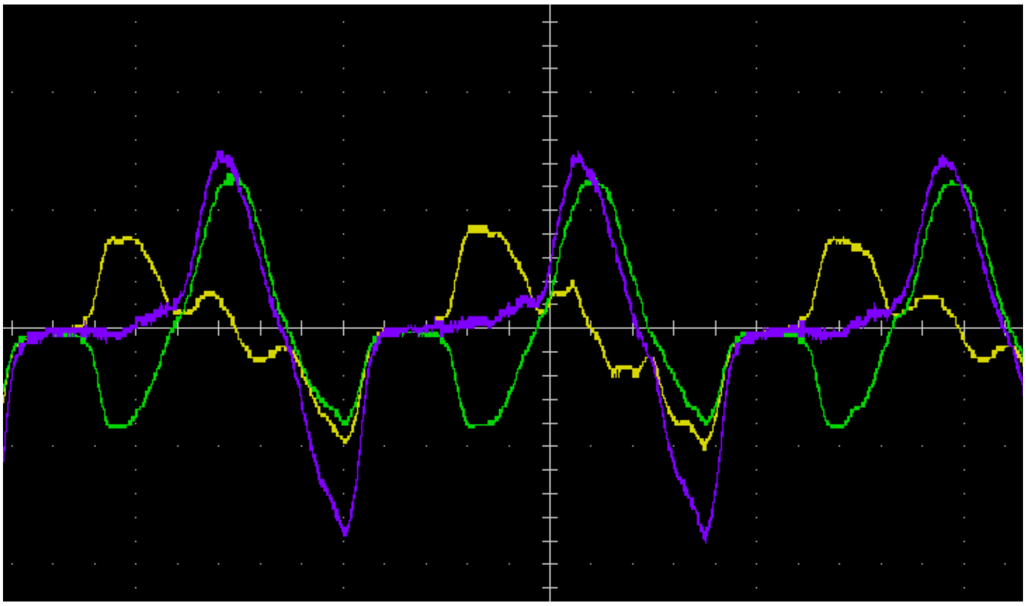

*Fig.2 Armature potential and synthetic potential*

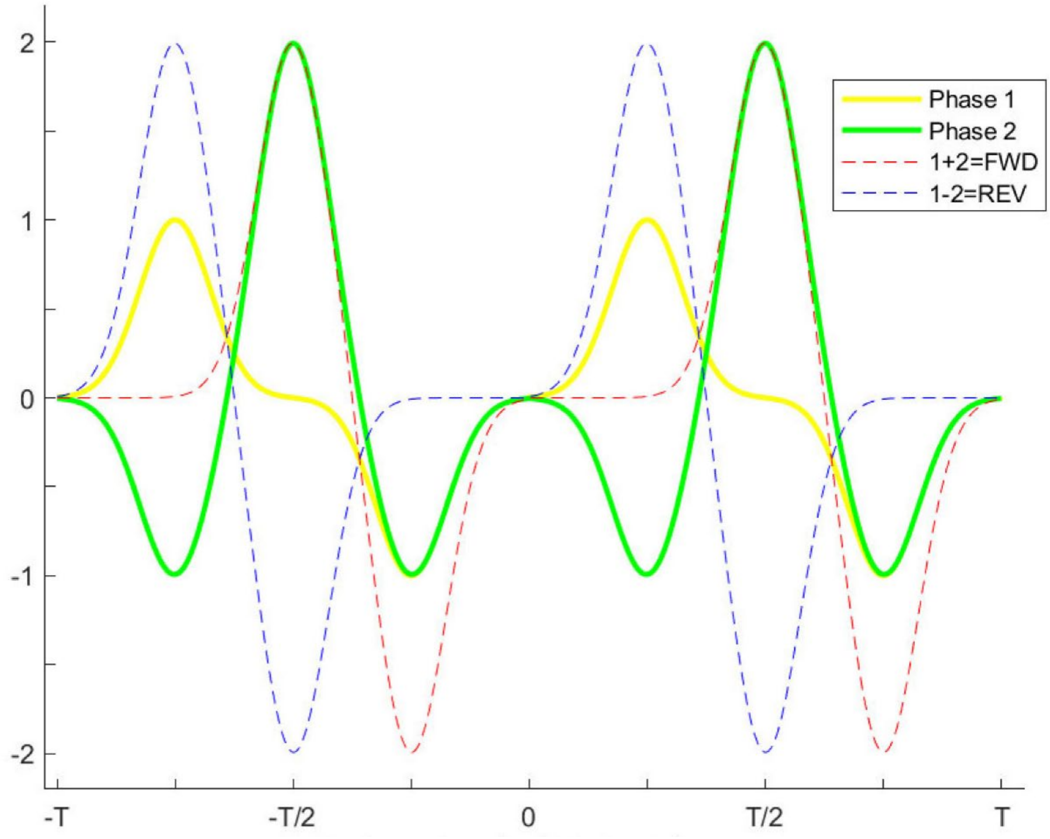


*Fig. 3 electrodynamic potential simulation curve*

Figures 2 and 3 are the waveform test diagram and simulation curve diagram of the motor armature coil. The yellow wave in the figure is generated by the coil between the same magnetic poles, which is recorded as phase 1 wave, and the green wave is generated by the coil between the different magnetic poles, which is recorded as phase 2 wave. The phase 2 wave is stable and propagates independently along the wire. Its positive and negative amplitude difference is about 1 times. There are two arches with the same polarity in the direction of low amplitude, and the two arches are separated by zero potential. In short, it has both AC and DC properties and is a typical polar wave. The phase 1 and phase 2 waves are two fundamental waves, and the purple wave is their synthetic wave. Obviously, there is a reverse synthetic wave missing in Figure 2, but it appears in Figure 3. The two synthetic waves appear due to different wiring forms between different coils. Different waveforms are the result of different topology selection.

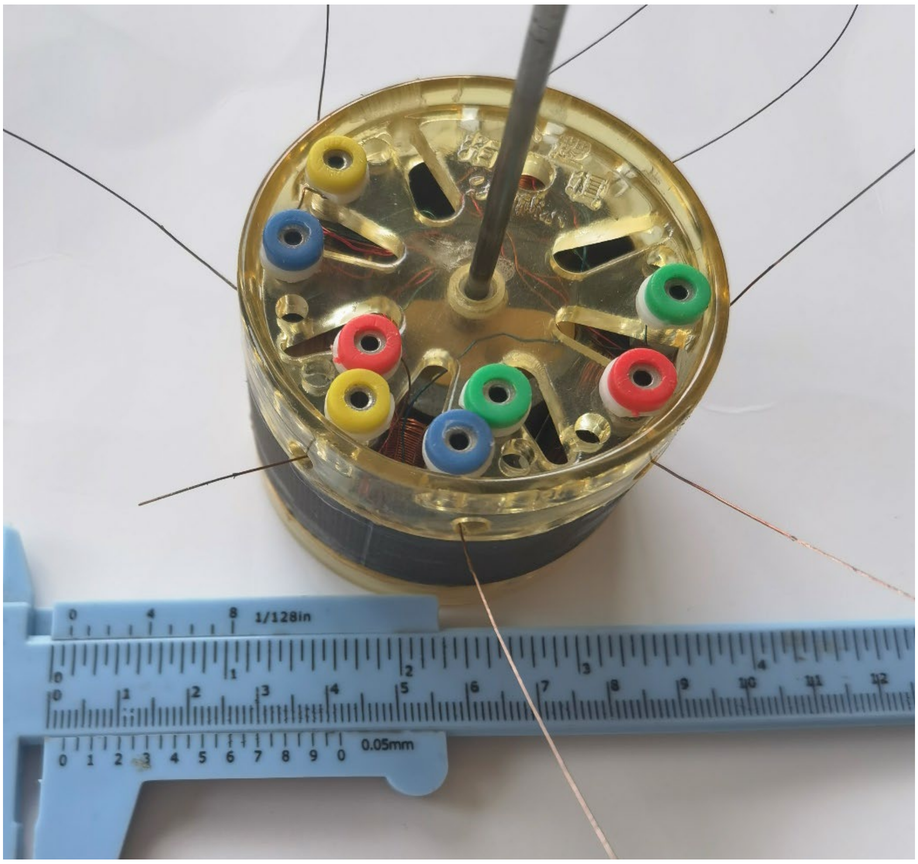


*Figure 4 Motor with multiple connectors*

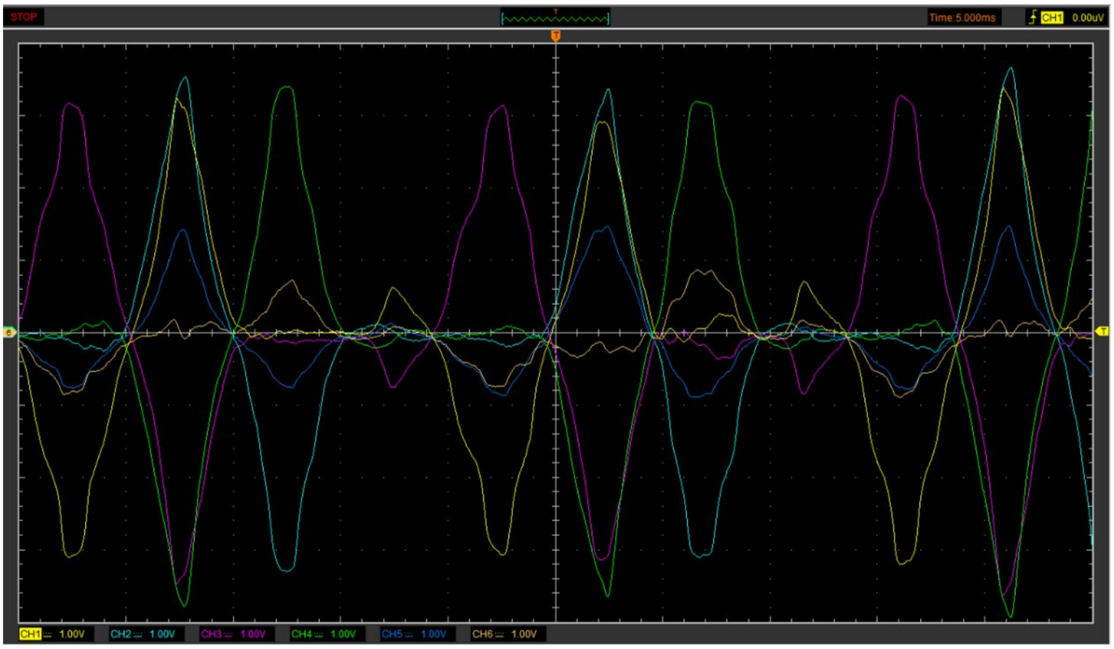


*Fig. 5 Conjugate electromotive force measurement screenshot*

Because of the existence of mutual inductance, the use of opposite coils can make the motor output these two fundamental waves and their inverse waves at the same time. By selecting different wiring methods, four conjugate electromotive forces can be synthesized and exist at the same time. As shown in Fig.5, the rotor with large salient pole ratio is intentionally used in the experiment, and the ripple is increased as a marker. In the figure, channels 5 and 6 are in the form of fundamental wave, and channels 1~4 are synthetic electromotive force. The four waveforms that exist at the same time are mirror symmetry and rotational symmetry, which can be regarded as the results of four logical operations of a waveform.

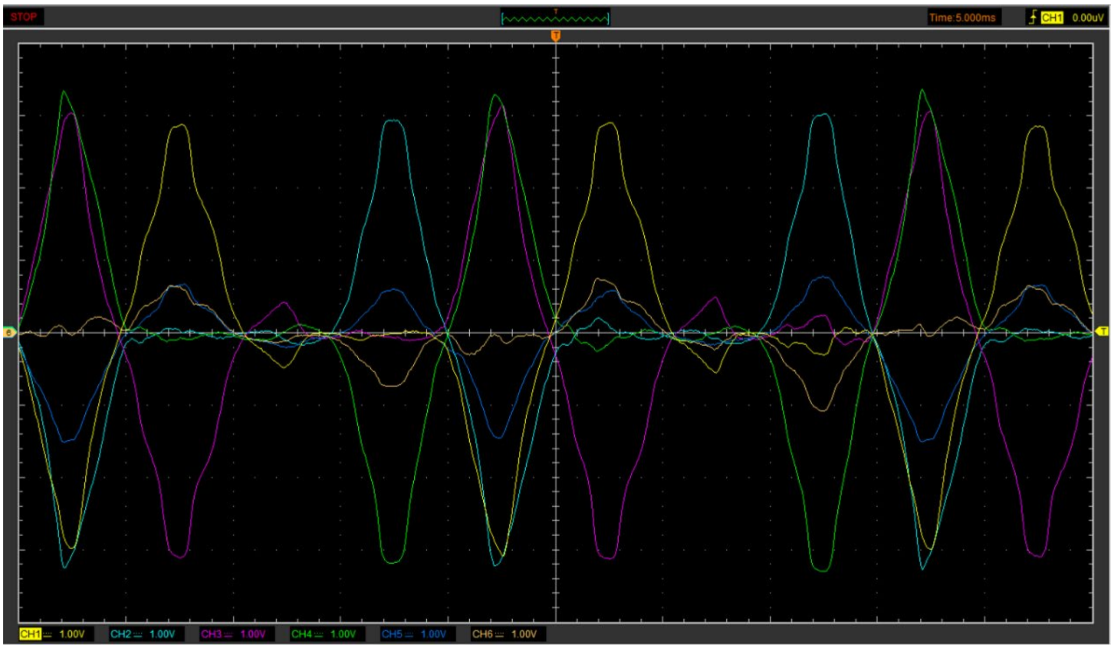


*Fig. 6 The electric potential moving in the opposite direction*

Fig.6 is a test screenshot of the opposite direction of motion. The topology and the junction column do not change anything, but only change the direction of motion. It can be seen that the reverse motion is equivalent to the image rotation of 180 °. In addition, changing the direction of the magnetic pole will also flip the image up and down.

In summary, the test results of one movement direction of the motor in Fig.1 are not unique. There are multiple equivalent results at the same time through logical operations : commutation operations such as winding direction, wiring sequence, and magnetic pole direction, the image will flip up and down, while the reverse movement is another logic : the coordinate axis is all flipped.

## 2 Mirror coil experiment

Interestingly, the mirror coil experiment is a secret experiment that is afraid of being disturbed. Only in the case of a pair of mirror windings, there are different observation results. Otherwise, as shown in Fig.5 and Fig.6, there are multiple channel observations.

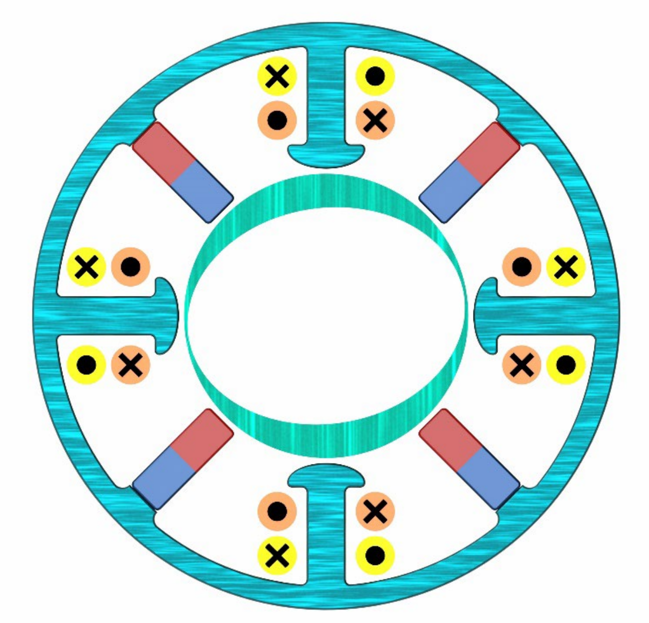

*Fig.7 Motor with opposite winding*

As shown in Figure 7, the two sets of coils of the brass winding and the red copper winding have completely opposite winding directions. Each color of the winding needs to be connected in series alone, and they produce an electromotive force with opposite phases. If only the end points are connected in series, then the output electromotive force depends entirely on which set of coil length, and the waveform is similar to the purple wave in Figure 2. However, if one group of coils is shorted and the other group is tested, then similar to the modulated resonant cavity, different waveforms can be output by controlling the number of turns of the two groups of coils, that is, there are many results.

Fig.8 is the experimental device diagram. The right side is the power source as shown in Fig.1, which is driven by 50 Hz mains, and the left side is the measured device of the reciprocal coil as shown in Fig.7.

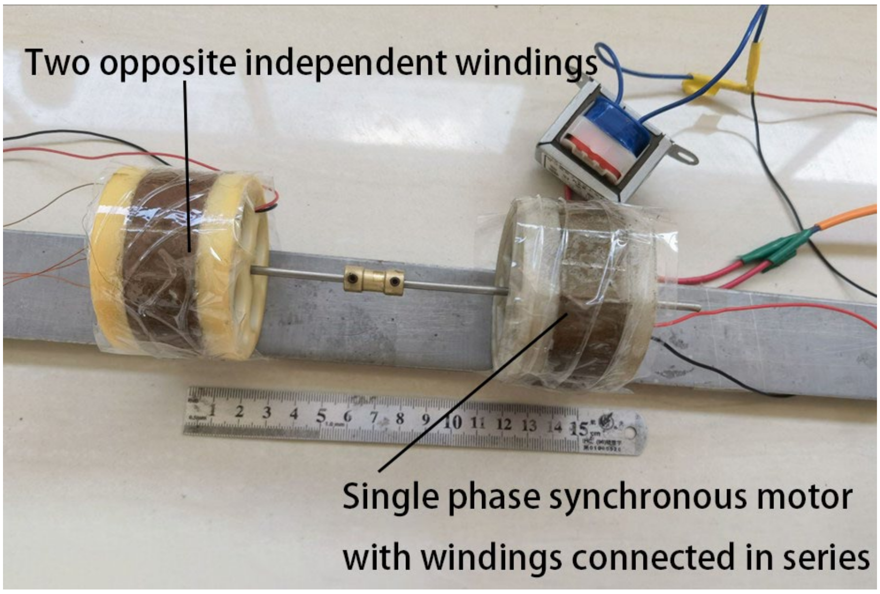


*Fig. 8 Experimental assembly drawing*

It is very special that when a pair of mirror coils are wound around and one of them is shorted, even if the topology is no longer changed, only the direction of motion is changed, the output waveform of the motor in the reciprocal direction will be significantly different : one direction is the same amplitude, the opposite direction is the polar wave with great difference between positive and negative amplitude.

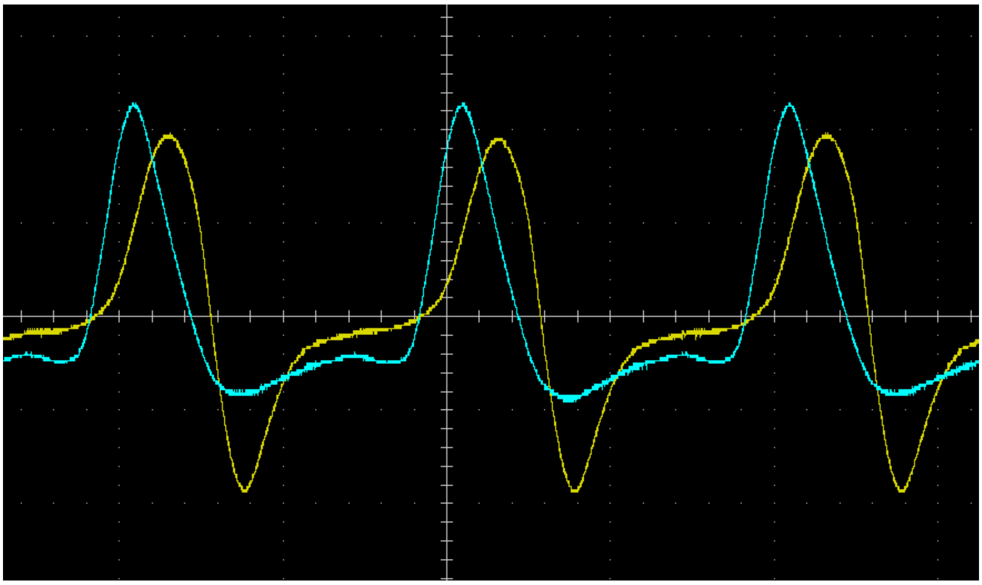

*Fig.9 The electromotive force in two opposite directions*

Fig.9 is the electromotive force waveform in two opposite directions. Yellow is the test direction, and blue is the waveform that is saved and loaded after testing in the opposite direction. It can be clearly seen that the double arch hole in Fig.2 or Fig.3

becomes a blunt bottom wave, and the 0 potential interval disappears. That is to say, only one motion direction in Figure 9 shows polarity, which can be demonstrated by led light bulbs [ 4 ]. Under the appropriate number of turns and the speed of movement, the bulb will be on in a certain direction of movement regardless of whether the joint is intermodulation. However, in the opposite direction, the intermodulation joint causes the bulb not to light, destroys the motion symmetry, and produces logical confusion. Again, the mirror coil groups must be independently connected in series, short-circuit one group, measure another group, disassemble the measurement or add additional measurement channels, will not observe this wonderful result, natural anti-eavesdropping. In this experiment, compared with Figure 5 or Figure 6, the logical rules have changed, and the same topological structure has responded differently to the movement in different directions, and the images in different directions have no symmetry at all, the formal symmetry is disrupted.

*Table 1 Ripple suppression test*

| *Hz* | *e=f* | *N-e* | *N-e* | *N+f* | *N+2e+2f* | *FWD voltage* | | *REV voltage* | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | *Max* | *Min* | *Max* | *Min* |
| *50* | *2* | *54* | *54* | *58* | *64* | *1.43V* | *-816mV* | *1.13V* | *-1.15V* |
| *50* | *4* | *52* | *52* | *60* | *72* | *1.41V* | *-800mV* | *1.15V* | *-1.13V* |
| *50* | *6* | *50* | *50* | *62* | *80* | *1.47V* | *-847mV* | *1.18V* | *-1.22V* |

This experiment requires that the number of turns of the two sets of coils is equal or the proportion remains unchanged, and the waveform will remain basically unchanged. The test results are shown in the table above. In Table 1, N represents the number of basic turns, that is, the number of turns per coil of the short-circuit winding and the number of basic turns of the test winding. In the experiment, N = 56. e and f represent the number of corrected turns of the test winding, and e = f can ensure that the waveform will not be offset up and down. The number of turns of the four coils of the test winding is N-e, N-e, N + f, N + 2e + 2f in the table, and the last two turns are more, which are the armature between the different magnetic poles and the armature between the same magnetic poles next to it. Doing so can suppress the ripple.

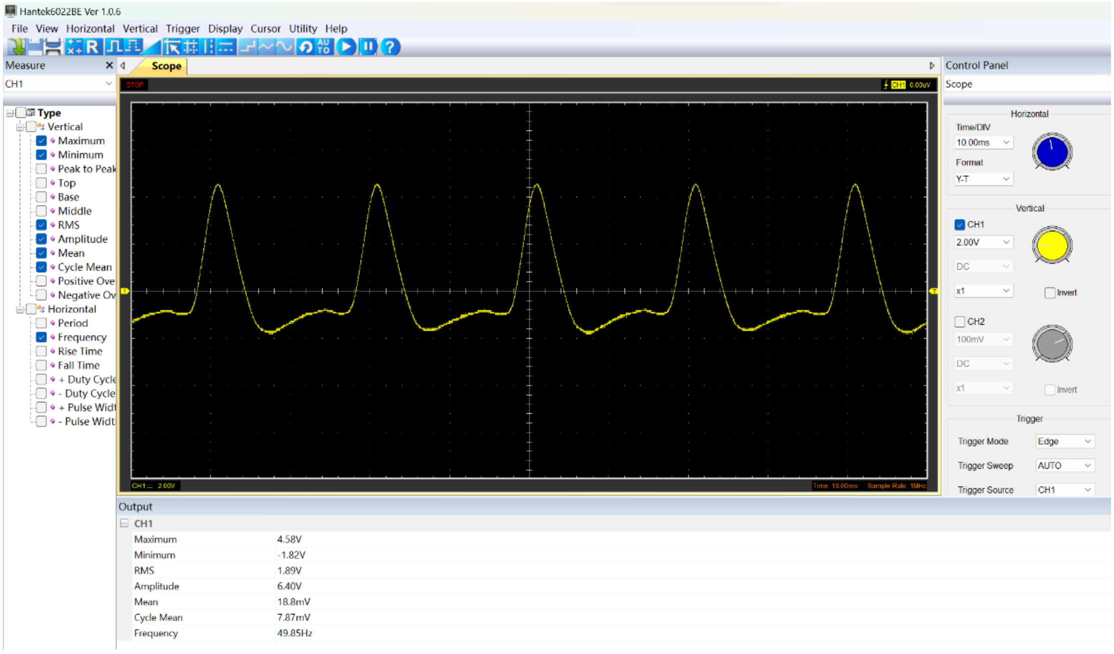

*Fig. 10 Polar wave with relatively large amplitude*

In the experiment, it is also found that increasing the coil base N can increase the positive and negative amplitude ratio of the polar wave. As shown in Table 1, the amplitude ratio of the polar wave is about 1 : 1.7, and when N > 100 turns, the amplitude ratio can exceed 1 : 2, as shown in Figure 10, reaching 1 : 2.5, which can well test the logic confusion just mentioned. By the way, the amplitude ratio seems to be less affected by the motion frequency.

## 3 Supplementary experiments on polar wave

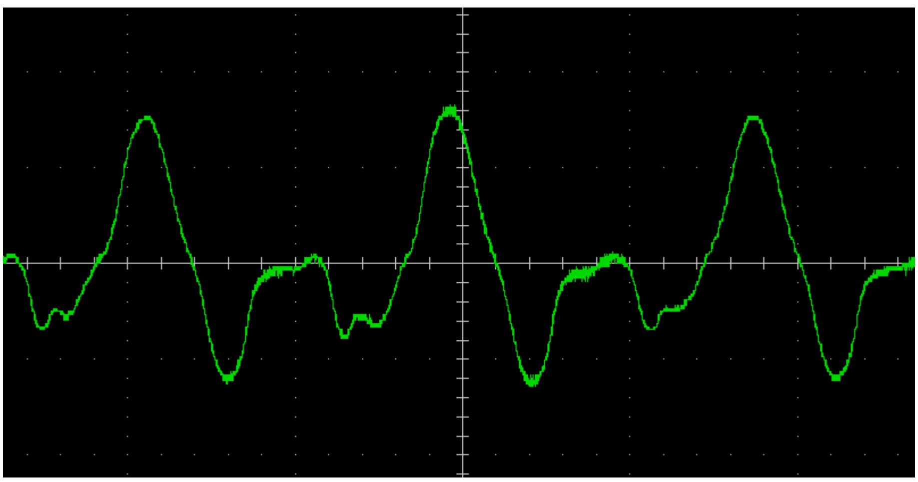

*Fig.11 Distorted polar wave*

Remove a magnet from the motor in Figure 1, the armature coil waveform between the different magnetic pole groups is shown in Figure 11, and the double arches are obviously different in size .

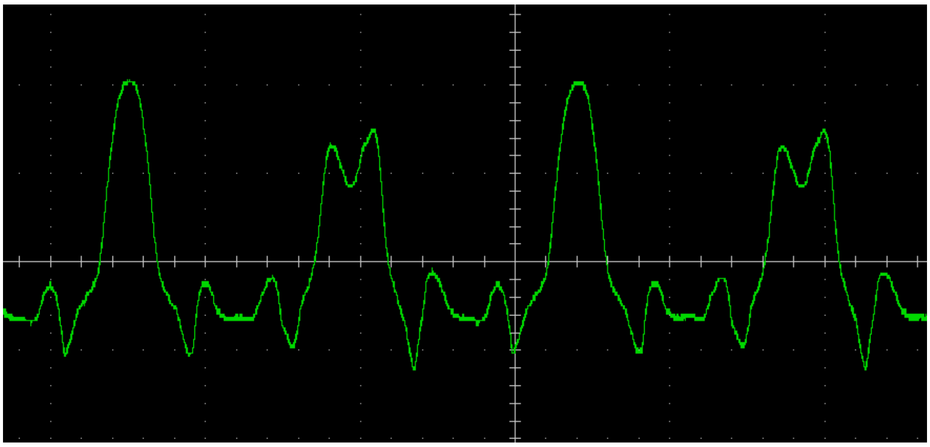

*Fig.12 Polar waves when the homonymous magnet group is 3*

By adding a magnet to the homonymous magnetic pole group of the motor in Figure 1, that is, three homonymous magnetic poles and then arranging the opposite magnetic pole group, the polarity waveform is shown in Figure 12, which is an arch more than Figure 11. The same magnetic pole group continues to increase to four, and the waveform is still similar to Figure 12, so the observable arch of the polar wave may be limited. In addition, polar waves are extremely sensitive to inductance and will soon evolve into simple harmonics.

## 4 Simple analysis

It can be seen from Fig.10 that the polar wave is a synthetic wave with many components, and each pole contributes components. Combined with Figure 11, it can be seen that the polar wave is sensitive to the magnetic flux path. In fact, in addition to the short-circuit path through the armature, the magnetic flux of the motor in this paper also has a path directly connected to the magnetic pole. The magnetic flux of the direct connection path is doing energy storage transformation, regardless of the vector direction, resulting in multi-mode oscillation. The topological structures such as magnetic pole direction, winding direction and wiring mode can be logically selected. Each selection may introduce additional roots, which makes the observation circuit logic more complicated.

Because of the existence of mirror topology, the form of wave function involved in this paper is not unique. The following approximate waveform functions are for reference only。

Phase 1 wave : $f(t) = \sin\left(t + \frac{\pi}{4}\right)$ ①,

Phase 2 wave : $g(t) = \sin\left(t - \frac{\pi}{4}\right) - \sin(2t)$ ②,

The composition of 1 and 2： $F(t) = f(t) + g(t) = \sqrt{2}\sin t - \sin(2t)$ ③,

or $G(t) = f(t) - g(t) = \sin(2t) - \sqrt{2}\cos t$ ④

The blue wave in Figure 9or the waveform in Figure 10 is

$$S(t) = \sqrt{2}\sin t - \frac{\sqrt{2}}{2}\cos t - \sin t \cdot \cos t \qquad ⑤$$

## 5 Summary

In this paper, a polar synthetic wave and its motor device are introduced. It shows that there are multiple logically equivalent observation results in an electromagnetic motion system, and when one group of mirror mutual inductance windings is short-circuited, another group is measured, and the formal equivalence of the measurement results will be destroyed. At present, we do not know the cause of this logical destruction, and lack detailed and accurate mechanism research. We hope that interested researchers can err or continue to study.

All the experimental contents in this paper are completed by myself independently.

I am responsible for the authenticity of all data. Researchers are welcome to reproduce and expand the experiment.

## Reference:

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