OSCILLATORY MOTION OF FERRO-MAGNETIC SUSPENSION UNDER THE EFFECT OF ROTATING ELECTRO-MAGNETIC FIELD

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Abstract

Behaviour of ferro-magnetic suspension under the effect of rotating electro-magnatic field is a very strange behaviour. The practical data shows that under a certain conditions the motion of ferro-magnetic suspension can be controlled by introducing a rotary electro-magnetic field arround this suspension. This motion takes the following forms:

- Only in the direction of electro-magnetic field;
- Only in the direction anti electro-magnetic field;
- Anti electro-magnetic field and then tends to zero (stand still);
- Firstly anti the electro-magnetic field and then with field;
- Oscillatory motion decayed with time;
- Continuous oscillation.

This article deals only with the last two casses because all others was published prevously by the author.

Of course this motion has a wide application in industry and technological processes. Also on the bases of such motion many devices was

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constructed and can be applied in technological processes.

I. Introduction

The motion of ferro-magnetic suspension was investigated in the previous works [1] - [9] . At acertain condition this motion have many direction as follows:-

1- Only in the direction of electro-magnetic field.
2. Only anti electro-magnetic field.
3. Firstly antifield and then with field i.e. the ferro-magnetic suspension changes its motion one-time only.
4. Vibrating motion have the form of simple harmonic type.
5? Oscillatory motion i.e. the ferro-magnetic suspension changes its motion many times (the reversing processes repeated in a condition the firist motion anti-electro-magnetic field direction).

II. Practical data

Fig.1 illustrats the oscillatory motion of ferro-magnetic suspension under the effect of rotory electro-magnetic field). As indicated in fig. 1 the ferro magnetic suspension started the motion andi the main field with high speed (a-b), this speed decreased (b-c), then tendes to zero (c-d). After that the motion completly reversed and increased with time in the forword direction (d-e), again the speed decreased with time (e-f) and tends again to zero(f-k). This cycle repeated with different-periodic time of oscillation i.e. $T_1 \neq T_2 \neq T_3$ as indicated in Fig.1. According to the practical data, there are two cycles was registered. These cycles have the following characteristic.

<u>w.r.t. the first shape of oscillatory motion</u>

a- The values of maximum speed of rotation in the direction of electro-magnetic field are constant. $W_{2\,max} = W_{4\,max.} = W_{6\,max.} =$ Const.

b- In the direction of rotation form anti field to with field, the dead zone δ ,sec.decreased $\delta_1 > \delta_3$ and during the reversing form rotation with field to antifield this zone increased $\delta_2 < \delta_4$ as in Fig.1.

The resultant of expermental data was tabulated in table 1. Fig.1 illustirats the relation between the speed of rotation of ferro-magnetic pulp w rev./min. and time t;sec. we must rember that this oscillatory motion obtained under certain constant conditions the most of them are the following:-

1- Concentration of ferro-magnetic material in suspension.
2- average size particle of solid phase.
3- Intensity of electro-magnetic field corrosponding to constant current in the stator winding.
4- Viscosity of surrounding medium.

<u>w.r.t. the second shape of oscillatory motion</u>

Fig.2 illustrate the second shape of this motion and table 2 indicats the registerd data. This cycle was obtained under the same condition as in case one but the intensity of magnetic field decreased (current in the stator winding 4.5 A. but in the first case 5.5 A), and viscosity of the surrounding medium is less than in first cases.

If we consider the dead gone period D_1D_2 in one point D Fig.2, it is possible to approximate the dashed line X with the continuous one Y. of course the period of oscillation is a function of the mentiond parameters, but the most important one & has a great effect is the viscosity. Table 2 shows the registered data.

It was published in the previous works [1] - [9] the phenomenon of reversing but this article deals with the phenomenon of oscillation of ferro magnetic suspension under the effect of rotating electro-magnetic field.

III. Conclusion

The phenomenon of oscillatory motion of ferro-magnetic suspension can be applied in technological processes and industry for the following purposes.

1- Consturstion many devices for measuring & controlling viscosity, size particle, density of magnetic pulps. Also for measuring and controlling magnetic susebtability and others.

2- Construstion magnetic separator based on the phenomenon of oscillation, or phenomenon of reversing or one from the previous motions.

Table I

t, sec.	7.5	20	30	35	50	55	60	68
w; rev. /min	-26	-14	-4	0	0	+6	+10	+16
t sec	78	83	86	90	100	110	127	145
w rev. /min	+8	0	0	-22	-12	-10	-8	-4
t sec.	154	162	165	173	187	193	197	208
w rev. /min	0	0	+4	+16	7	0	0	-14

Table 2

t, sec.	2.5	10	12	16	17.5	22.5	30	36.5
w rev. /min.	-42	-12	0	0	+12	+14	+12	+4
t sec.	40	43	46	49	57.5	63.5	65.5	70
w rev. /min	0	0	-6	-10	-7	0	0	+6
t sec.	72.5	80é	87.5	92.5	95	-98	102	
w rev. /min.	+12	+14	+9	+4	+2	0	0	

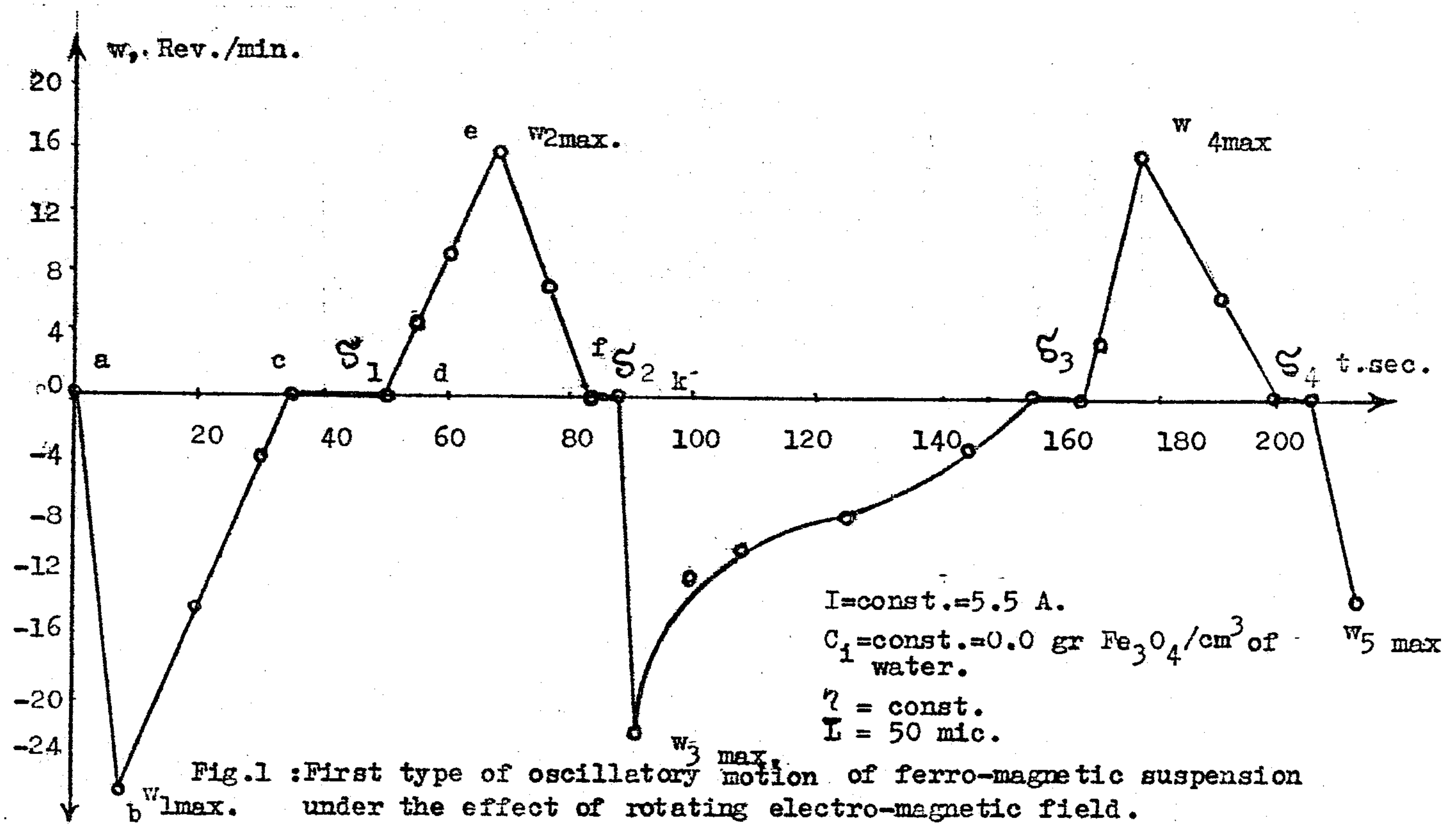

Fig.1 :First type of oscillatory motion of ferro-magnetic suspension under the effect of rotating electro-magnetic field.

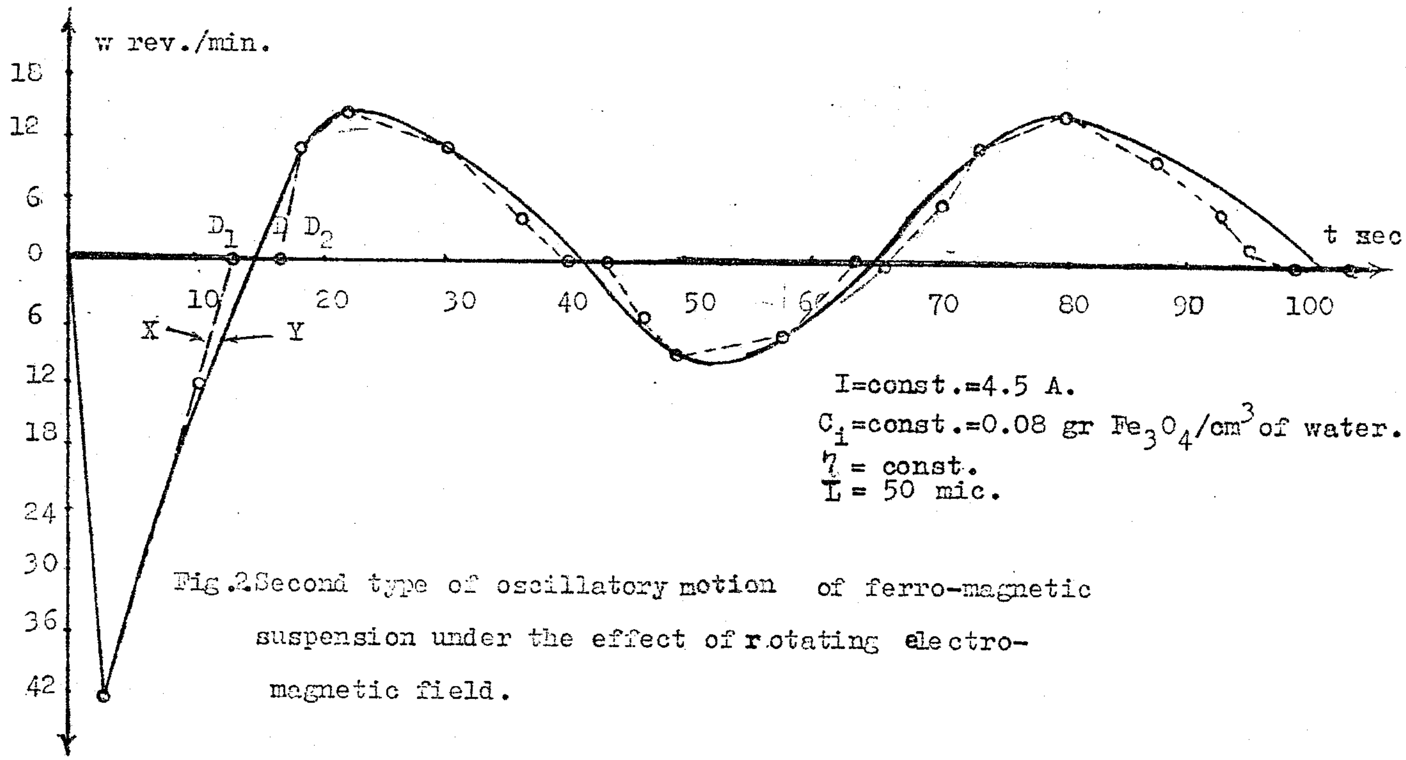

Fig.2 Second type of oscillatory motion of ferro-magnetic suspension under the effect of rotating electro-magnetic field.

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يهدف البحث الى استكمال الدراسات السابقة التى قام بها الباحث فى هذا المجال ويتضمن النقاط الجديدة التالية :ـ

أ ـ حركة المعلقات المغناطيسية يمكن ان تكون حركه تذبذبيه او ترد ديه حسب الظروف المحيطه بالمعلق .

ب ـ عن طريق هذه الحركه يمكن تصميم عده أجهزة تستخدم فى التحكم الالى للعمليات التكنولوجية الانتاجية فى استخلاص الخامات المعدنية وغيرها .

جـ ـ توصل الباحث الى هذه الظاهره التى تربط مجموعة من العلوم الطبيعية ببعضها والتى سوف تفتح مجالات مختلفة بالنسبة للمتخصصين فى مجال

ELECTRO-MAGNETO-HYDRO-DYNAMIC.