Rang Correlation of Spirmen that Uses for Determining Oil Well Interaction

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***Abstract*— As a result of the exploration and experimental data three year period getting from the three side by side acting oil extraction wells and the using coefficient rang correlation of Spirmen are determined degree of interaction the well. Finally it is shown that estimate technological efficiency necessary carry out for all the section oil field as increasing oil extraction from the one well perhaps bring to the decreasing oil extraction from the neighboring interaction wells. It has been shown that estimate technological efficiency necessary carry out for all the oil field section as increasing oil extraction from the one wells perhaps bring to the decreasing oil extraction from the neighboring interactions wells.**

***Keywords*— rang correlation; well; normal distribution; parameters; increase; decrease**

I. INTRODUCTION

The sufficiently complicated processes of motion stratum liquid and availability interaction between the wells as on the stratum and external under systems non-stop changes work condition for the extracted wells and depreciated the effort using individual optimization for every wells and besides optimal work individual wells, as a rule, non-means optimal works all the stratum systems [2, 4]. All the factors proved that using system approach to the optimization of the extraction wells fund, taking into consideration between neighboring wells interaction (correlation) directed to the increase oil return is one of the topical problems.

II. PROBLEM FORMULATION

In the non-parametrical statistic theory choosing correlation measure indicated using rang correlation coefficient [1-3]. Rang correlation (RC) is dependence measure between accidental values (between oil wells debit), when the dependence impossible quantitative determining by ordinary correlation coefficient.

RC settling procedure is object studying arrangement to the relationship some of sign, that is ascribed them ordinal numeral number – rangs (on the numeral is accordingly with two observed signs between which correlation is studying),e.g., more values for variable marking as number 1, second on the values – number 2 and so on. Most spreading have the Spirmen's rang correlation coefficient (SRCC) which is most simple and comfortable for calculation in the industrial conditions.

The practical calculation consist following stages:

1. Comparison to the each of signs their numeral number (rang) on the increase (or decrease);
2. Determining difference of the rangs for each pair compared values;
3. Raise to the square each difference and sum up getting results;
4. Calculation SRCC.

SRCC for non-correlation rangs calculated using following formula:

$$r_s = 1 - \frac{6\sum_{i=1}^{n}(x_i - y_i)}{n(n^2-1)} = \frac{6S_r}{n(n^2-1)},$$

where $i = 1,2,...n$; x_i, y_i are the relative rangs appropriated the first and second signs; n - maximal choosing number.

III. PROBLEM SOLUTION

As experimental data three year periods getting from the three side by side acting oil extraction wells as shown in the table has correlation rangs ($u_1=7;\ u_2=9;\ u_3=6$), we use SRCC for correlation rangs:

$$r_s(xy) = \frac{\frac{n}{6}(n^2-1) - S_r - U_x - U_y}{\sqrt{\left[\frac{n}{6}(n^2-1) - 2U_x\right]\left[\frac{n}{6}(n^2-1) - 2U_y\right]}}, \quad (1)$$

where

$$U_x = \frac{U_1}{12}(U_1^2 - 1);\ U_y = \frac{U_2}{12}(U^2 - 1),$$

U_1, U_2 are the relative number of rangs. As shown from table that $U_1=7,\ U_2=9;\ U_3=6$.

Using experimental data (see at the table) in the result of calculation we get:

$$S_r(x,y) = \sum_{i=1}^{36}(x_i - y_i)^2 = 2271$$

$$S_r(x,z) = \sum_{i=1}^{36}(x_i - z_i)^2 = 2717$$

$$S_r(y,z) = \sum_{i=1}^{36}(y_i - z_i)^2 = 718\ .$$

TABLE I. EXSPERIMENTAL DATA OF OIL WELLS

i	*W1 regime* q_r*-M*^{3}*/d*	*Rangs* x_i	*W2 regime* q_r*-M*^{3}*/d*	*Rangs* y_i	*W3 regime* q_r*-M*^{3}*/d*	*Rangs* z_i	y_i-x_i	$(y_i-x_i)^2$	z_i-y_i	$(z_i-y_i)^2$	z_i-x_i	$(z_i-y_i)^2$
1	5,1	2	14,3	1	15,3	4	-1	1	+3	9	+2	4
2	5,1	2	14,0	3	15,6	2	+1	1	-1	1	0	0
3	5,0	3	14,1	2	15,1	6	-1	1	+4	16	+3	9
4	5,0	3	13,6	5	15,6	2	+2	4	-3	9	-1	1
5	5,1	2	13,4	7	15,6	2	+5	25	-5	25	0	0
6	5,0	3	13,5	6	16,2	1	+3	9	-5	25	-2	4
7	5,0	3	12,9	10	15,5	3	+7	49	-7	49	0	0
8	5,1	2	12,7	12	15,3	4	+10	100	-8	64	+2	4
9	5,1	2	13,2	8	15,2	5	+6	36	-3	9	+3	9
10	5,1	2	13,5	6	15,3	4	+4	16	-2	4	+2	4
11	5,2	1	13,0	9	14,6	8	+8	64	-1	1	+7	49
12	5,1	2	12,9	10	15,0	7	+8	64	-3	9	+5	25
13	5,0	3	13,7	4	14,5	9	+1	1	+5	25	+6	36
14	3,8	4	12,6	13	15,0	7	+9	81	-6	36	+3	9
15	3,1	7	12,9	10	14,1	10	+3	9	0	0	+3	9
16	3,1	7	12,8	11	14,0	11	+4	16	0	0	+4	16
17	2,7	11	12,7	12	13,9	12	+1	1	0	0	+1	1
18	3,6	5	12,1	14	13,0	14	+9	81	0	0	+9	81
19	2,9	9	13,6	5	13,2	13	-4	16	+8	64	+4	16
20	2,8	10	11,4	15	7,6	28	+5	25	+13	169	+18	324
21	2,7	11	10,6	20	8,4	26	+9	81	+6	36	+15	225
22	2,7	11	10,1	22	8,5	25	+11	121	+3	9	+14	196
23	2,6	12	10,5	21	9,5	22	+9	81	+1	1	+10	100
24	3,2	6	9,8	23	8,9	23	+17	289	0	0	+17	289
25	3,0	8	10,9	17	10,7	16	+9	81	-1	1	+8	64
26	2,5	13	10,9	17	10,4	17	+4	16	0	0	+4	16
27	3,1	7	10,8	18	7,9	27	+11	121	+9	81	+20	400
28	2,8	10	10,7	19	10,2	18	+9	81	-1	1	+8	64
29	3,0	8	10,7	19	10,2	18	+11	121	-1	1	+10	100
30	2,8	10	10,7	19	10,1	19	+9	81	0	0	+9	81
31	2,7	11	10,5	21	11,1	15	+10	100	-6	36	+4	16
32	2,5	13	11,3	16	10,0	20	+3	9	+4	16	+7	49
33	2,7	11	10,8	18	10,1	19	+7	49	+1	1	+8	64
34	2,5	13	10,9	17	9,7	21	+4	16	+4	16	+8	64
35	2,6	12	10,1	22	10,0	20	+10	100	-2	4	+8	64
36	3,2	6	9,6	24	8,6	24	+18	324	0	0	+18	324
		$U_1=7$		$U_2=9$		$U_3=6$		2271		718		2717

IV. CONCLUSION

According to the mentioned above it may be concluded that estimate technological efficiency necessary carry out for all the section oil field as increasing oil extraction from the one wells perhaps bring to the decreasing oil extraction from the neighboring interaction wells. And the optimization problem solution can be realized on the base complex approach for all the oil field, bring to the increasing its exploitation profitable.

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