EXPERIMENTAL RESEARCHES REGARDING THE KINEMATICS OF TRIPOD COUPLINGS

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Abstract: *The paper presents experimental researches regarding the kinematics of tripod couplings with exterior contacts. First, there is presented the general testing algorithm; by using this algorithm and an experimental stand are measured the values of the angular position of the input and output shaft of the tripod coupling with exterior contacts. Finally it is determined the error from homokinetics and the experimental results can be compared to the theoretical results.*
Keywords: *tripod coupling, testing algorithm, error from homokinetics.*

1. INTRODUCTION

The measurement of the error from homokinetics is important so that it can be compared the kinematics behavior of different types of tripod couplings with exterior contacts (figure 1) [2]; by using an experimental stand there will be measured the following parameters:

- the angular position of the input shaft;
- the angular position of the output shaft;
- the time moment of the data acquisition.

2. TESTING ALGORITHM

The identification of the error from homokinetics is made by using the following steps [2]:

1. The alternomotor (the actuator) is connected to the electric board; the hydraulic break is not connected.
2. The motion of the alternomotor is controlled from the mainboard until the angular velocity is n_1=30 rot/min.
3. The data acquisition software is being run from the personal computer.

4. It will repeat the 1 – 3 steps for different values of the angle α between the axis of the input *1* and the output *2* shaft (figure 1).

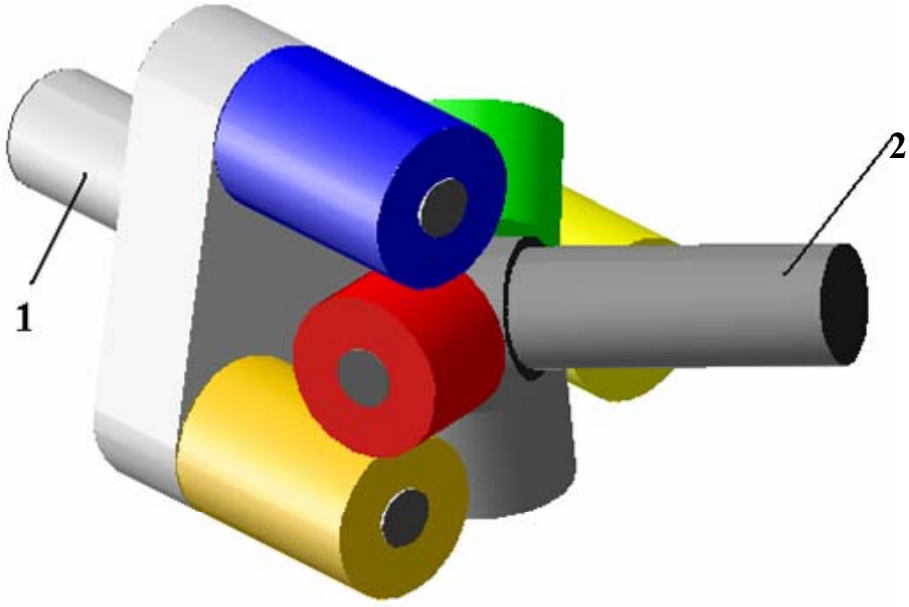


Fig. 1. Tripod coupling

The testing programs parameters are [2]:

n_1=30 rot/min;

$\alpha[^o] \in \{0, 10, 20, 30\}$.

The error from homokinetics is determined as a difference between the angular position of the input and the output shaft. The testing program will be repeated for different types of elements in contact: cylinders, paraboloids, hyperboloids.

3. TEST RESULTS

The results obtained after the experimental testing shows, finally, the variation of the error from homokinetics (ψ) with the angular position of the input shaft (φ_1), for different parameters: the angle between the input and the output shaft (α); the exterior contact types: cylinder on cylinder (*Cil/Cil*), paraboloid on paraboloid (*Par/Par*), hyperboloid on hyperboloid (*Hip/Hip*).

The diagrams are presented in table 1.

Table1. Measurement results

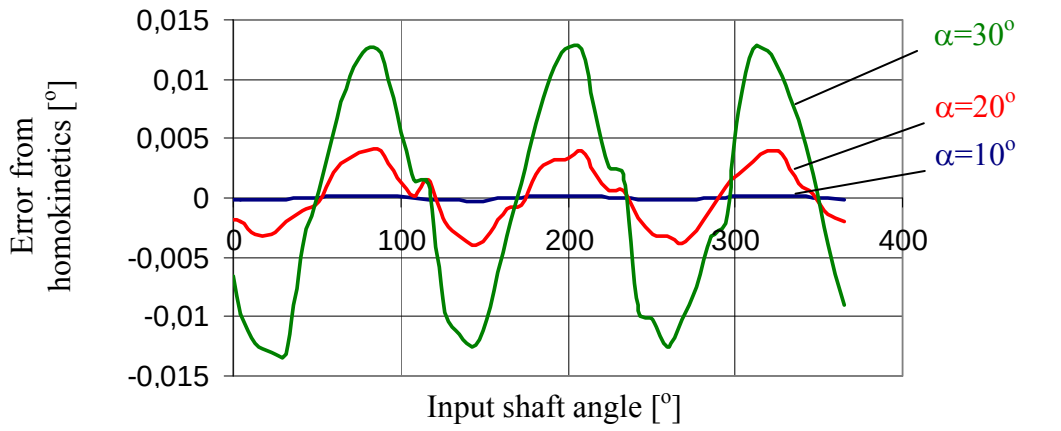
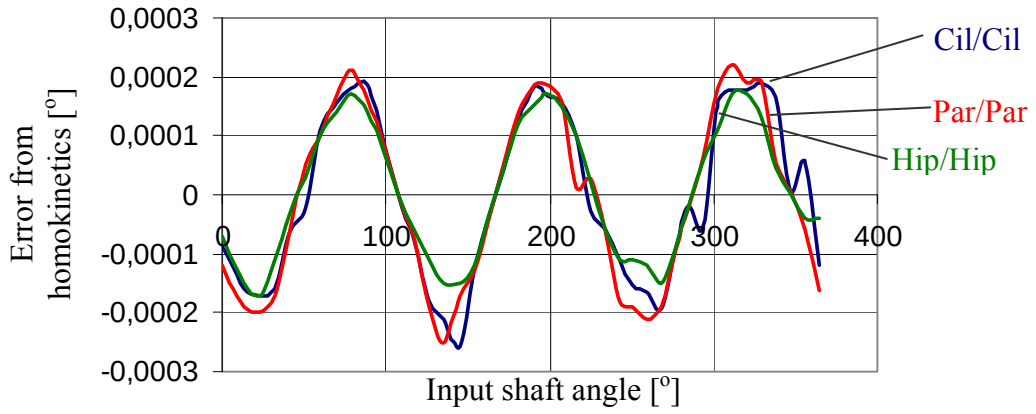
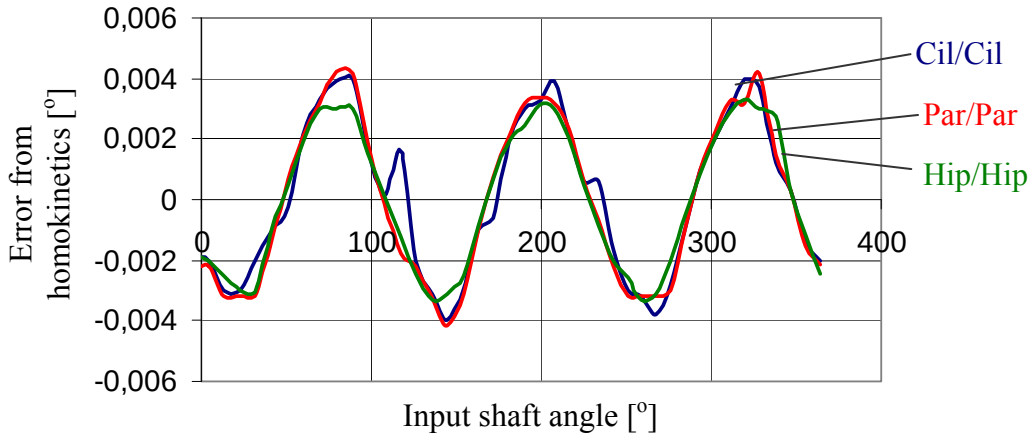
Parameter	Results (error from homokinetics vs. input angle)
0	1
Cil/Cil	
α=10°	
α=20°	

Table1. Measurement results

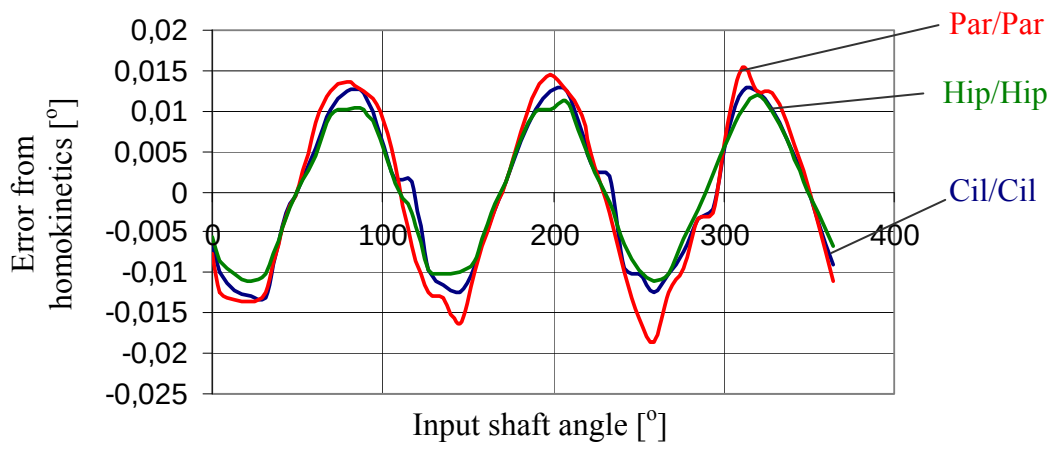
0	1
$\alpha=30^o$	

Table 2. Measurement values.

Nr. exp.	Time [s]	Output angle [grd]	Input angle [grd]	Error from homokinetics - experiment [grd]
0	0	0	0,00009	-0,00009
1	0,027	4,32016	4,32027	-0,00011
2	0,081	13,53662	13,53678	-0,00016
3	0,136	22,75215	22,75232	-0,00017
4	0,191	31,96792	31,96808	-0,00016
5	0,246	41,472	41,47207	-6,50E-05
6	0,301	50,688	50,68802	-2,15E-05
7	0,356	60,19771	60,19176	0,00011
8	0,411	69,695157	69,695	0,000157
9	0,466	79,19994	79,19976	0,00018
10	0,521	88,706496	88,70631	0,000186
11	0,576	98,208	98,20791	8,91E-05
12	0,631	107,424	107,424	1,00E-06
13	0,686	116,928	116,9281	-7,90E-05
14	0,741	126,432	126,4322	-1,80E-04
15	0,796	135,648	135,6482	-2,10E-04
16	0,851	144,864	144,8643	-2,58E-04
17	0,906	154,08	154,0801	-1,27E-04
18	0,961	163,296	163,296	-3,70E-05

Table 3. Compared results

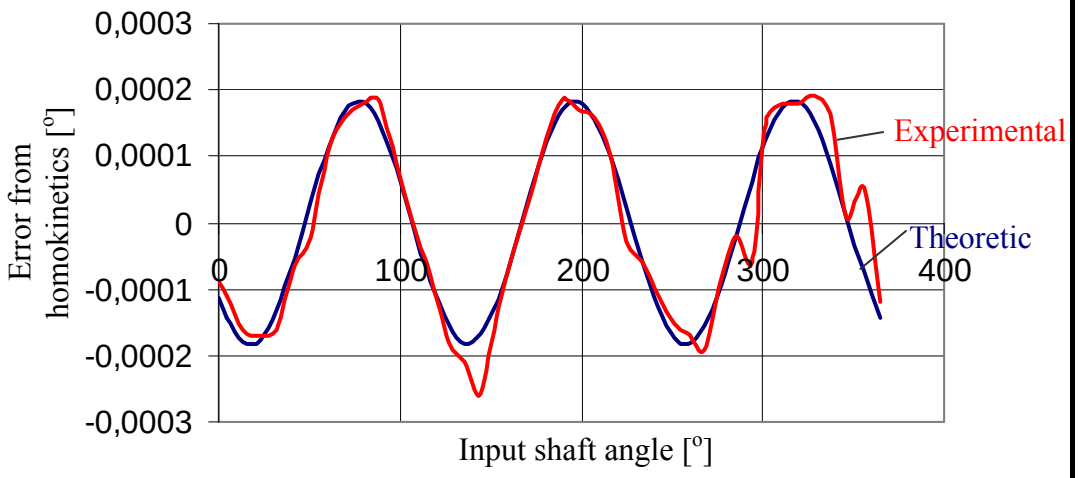
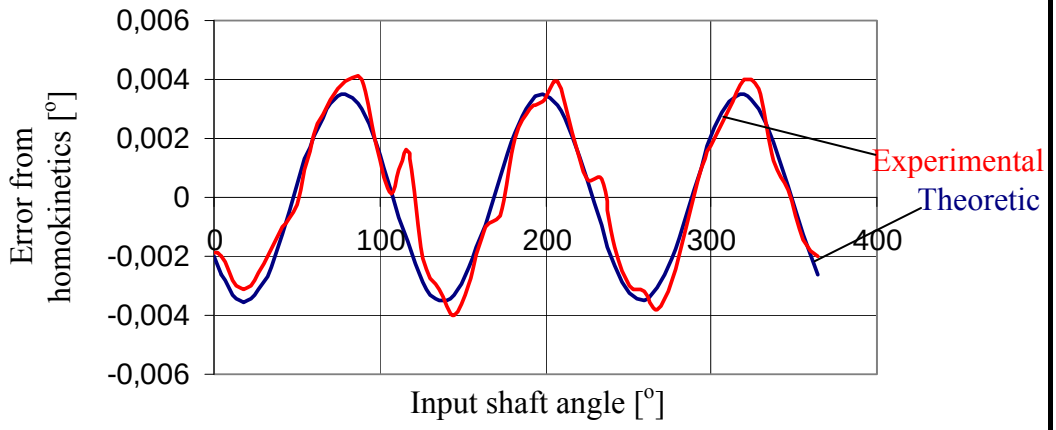
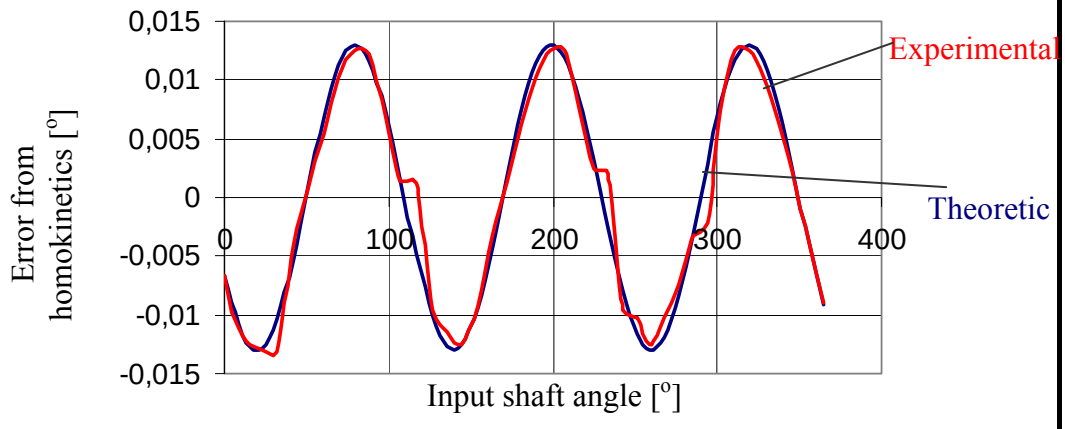
Parameter	Results (error from homokinetics vs. input angle)
Cil/Cil α=10°	
Cil/Cil α=20°	
Cil/Cil α=30°	

Table 2 shows a part of the measured values for different parameters. This sample is for the case of cylinder on cylinder contact and for the angle between the input and the output shaft $\alpha=10^o$.

4. VALIDATION OF RESULTS

To validate the measured results, table 3 presents the graphs of variation of the error from homokinetics, comparatively for the measured and the theoretical results [1]. The obtained graphs shows that the variation of the error from homokinetics, for the two cases (measured results and theoretical results) are similar; the measured values are close to the theoretical values. So there exists conformity between the theoretical and the measured results.

5. CONCLUSIONS

The values obtained for the error from homokinetics is small (less than $0{,}015^o$); so it can be considered that the analyzed tripod couplings with exterior contacts are homokinetik.

The coupling with hyperboloid on hyperboloid type of contact has minimum values for the error form homokinetics. The coupling with parabolic on parabolic type of contact has maximum values for the error form homokinetics. The variation of the error from homokinetics, for the two cases (measured results and theoretical results) is similar; the measured values are close to the theoretical values. So, there exists a conformity between the theoretical and the measured results.

To obtain minimum values for the error from homokinetics and minimum values for the local contact stresses it is recommended to use tripod couplings with hyperboloid on hyperboloid type contacts.

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