UDK: 629.11-235-192
COSATI: 13-06

Determination of an Optimal Strategy for Maintaining Motor Vehicle Clutches Using Polycriterion Optimization

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With an appropriate design of maintenance models, it is possible to perform optimization, i.e. to select the best possible maintenance system. If all the important requests and limits are precisely given, then it is possible to solve this kind of problems. The basis of the presented methodology consists of reliability parameters of the analysed vehicles obtained from monitoring vehicle behavior, from the aspect of failure occurrence in real operational conditions as well as of the costs of their maintenance.

Key words: **motor vehicle, vehicle maintenance, frictional clutch, process optimization, reliability, cost.**

Introduction

THE task of maintenance system optimization is to find an optimal solution. The aim of this work is to find a solution to optimize the motor vehicle maintenance system, a solution which will be the most acceptable for the maintenance of used vehicles.

The optimization of the maintenance system with the application model of preventive maintenance is often completed by finding an answer whether it is useful to apply preventive maintenance, and if it is, how much work time is needed to apply it.

Only one solution of maintenance strategy, for a given motor vehicle and given operational conditions, is optimal. Only in that case the best values of availability, reliability, minimal costs of exploitation and maintenance are obtained and all life cycle costs are reduced.

The aim of this work is to determine optimal maintenance of the clutch of a particular vehicle, on the basis of the parameters of its reliability obtained from the exploitation data.

Determination of the parameters of the motor engine reliability

If it is possible to determine the regularity which also encompasses the function of reliability distribution, then it is possible to determine all previously mentioned reliability parameters. This regularity can be determined if there are the data about the vehicle failure occurrence during its exploitation. One of principal elements in predicting vehicle behaviour in the future and its maintenance system optimization is finding an adequate mathematical model which can present the vehicle behaviour regularity from the point of view of failure occurrence. The methodology of determining the most acceptable maintenance model will be presented on an example of a particular vehicle and its clutch. A GF310K clutch, intended for special purpose vehicles, is the object of this research.

The values of the time to failure of the previous clutch, obtained by monitoring the vehicle during exploitation, are given in Table 1.

The law of the reliability distribution is determined on the basis of the data from Table 1.

Numerous characteristics of the statistical set are calculated:

- Average value: T_0=14 965,4 km, T_0 =499 h
- Standard deviation: σ_T=4 692,7 km, σ_T=156 h
- Median: t_{50} =13972 km, t_{50} =466 h

The determined values of reliability indicators of the vehicle clutch, which follow from Table 1, are obtained using known methodology [1,2,3] and presented in Table 2 and Figures 1 and 2.

Table 1. Values of time to failure for the clutch of the motor vehicle

Num-ber of failure	Path until failure (km)	Time to failure (h)	Number of failure	Path until failure (km)	Time to failure (h)	Number of failure	Path until failure (km)	Time to failure (h)
1	8243	275	18	12778	426	35	17384	579
2	8389	280	19	12935	431	36	17726	591
3	8756	292	20	12936	431	37	17752	592
4	8894	296	21	13186	440	38	17963	599
5	10128	338	22	13431	448	39	17981	599
6	10254	342	23	13757	459	40	19100	637
7	10280	343	24	13952	465	41	19196	640
8	10347	346	25	13972	466	42	19638	655
9	10387	347	26	14158	472	43	19882	663
10	10395	348	27	14373	479	44	20125	671
11	10656	355	28	14396	480	45	21492	716
12	10869	362	29	14563	485	46	23651	788
13	11496	383	30	14763	492	47	24697	823
14	11831	394	31	15938	531	48	26391	880
15	11863	395	32	16397	547	49	27391	913
16	11978	399	33	16967	566			
17	12382	413	34	17186	573			

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