IDENTIFICATION AND SELECTION OF THE OPTIMAL PARAMETERS OF THE AUTOMATIC CLUTCH CONTROL MECHANISM FOR TRUCKS

Blokhin Aleksandr*, Barakhtanov Lev*, Denisenko Elena*
*Nizhny Novgorod State Technical University n.a. R.Y. Alekseev, Nizhny Novgorod. The Russian Federation

Key words – Friction clutch, automatic mechanical transmission, pneumatic actuator, automatic control.

Research and/or Engineering Questions/Objective
With heavy city traffic or when driving on broken terrain, we must shift gears every often. This leads to the driver's fatigue and deterioration of his well-being, but also to an increase in errors while driving. This is especially true in the control of heavy trucks and buses. Providing of safety and high performance of heavy vehicles in these conditions may be effected by automation of the control of mechanical speed transmission, especially of a gearbox and a clutch. The aim of this work is the development of new technical solutions for creation of mechanisms of the friction clutch automatic control heavy-duty trucks and buses.

Methodology
In this work, models of the processes of declutching, gentle start and gear shifting are developed. Model verification is made on a specialized stand for testing of transmissions with command control and automatic control. The stand allows us to carry out the study of the efficiency of the transmissions (the clutch, the divider, the main gear, the splitter, the determination of the efficiency of the units, the study of the synchronization process, etc.) and mechatronic control systems for automatic or semi-automatic modes. At this stand, the clutch control algorithms for multi-stage mechanical gearboxes are worked out.

Results
Dependences of the gear shift time on the design parameters of the vehicle, engine, electromechanical clutch actuator are defined.

Limitations of this study
In this study, assumptions are made:
1. Air is the ideal gas;
2. The clutch fork and the clutch fork rod are absolutely rigid.
3. The spring stiffness is described by a piecewise linear function.
4. The process of heat exchange in a power chamber under compression of air is not taken into account.

What does the paper offer that is new in the field including in comparison to other work by the authors?
The proposed solutions allow to choose optimal parameters of new automatic clutch control mechanisms.

Conclusions
We considered the basic requirements applicable to the performance of the friction clutch control. A mechanism of the friction clutch automatic control was developed, with pneumatic drive, for heavy trucks and trains. A regression dependence of the displacement time of the clutch control acceleration mechanism piston was implemented, and experimental studies of the efficiency of the automatic clutch control mechanism on a were conducted on a specialized stand. We found out that the developed algorithms of the vehicle clutch control on the stand allowed us to reduce the dynamic loads when starting a vehicle by 4 times as well as time and work of the clutch slip, which significantly increases the longevity of the transmission units.