The research of thermal load of light weight tracked vehicle pneumatic/hydraulic spring

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The research of the pneumatic/hydraulic unit (PHU) internal dynamics is very urgent task. The research of heat load is of particular importance since it is thermal stress of cushioning system components that determines the performance of the structure. The article describes the research of PHU thermal load using mathematical simulation in Simulink / Simscape environment. Methods of thermal load estimation are based on the Schmidt method of finite differences. The results of the PHU operation dynamics research are presented. The results of simulation are shown and compared with the results of bench tests of a light weight tracked vehicle PHU. The recommendations for the calculation of the cooling system are given.

Keywords*: vehicles, pneumatic/hydraulic springs, cushioning system, experiment, running smoothness, heat-load, Schmidt method of finite difference, Simulink, Simscape, SimHydraulics.*

REFERENCES

[1] Smirnov A.A. *Matematicheskoe modelirovanie pnevmogidravlicheskikh ustroystv system podressorivaniya transportnykh sredstv.* Diss. cand. tekhn. nauk [Mathematical modeling pneumatic/hydraulic devices of vehicle cushioning systems. Cand. Eng. Sci. Diss.]. Moscow, 1999, 179 p.

[2] Zhileykin M.M., Kotiev G.O. Sarach E.B., *Nauka i obrazovanie — Science and Education*, 2011, no. 12. Available at: http://technomag.bmstu.ru/doc/346642.html

[3] Kotiev G.O., Smirnov A.A., Shilkin V.P. *Issledovanie rabochikh protsessov v pnevmogidravlicheskikh sistemakh podressorivaniya gusenechnykh mashin* [Research of working processes in pneumatic/hydraulic cushioning systems of tracked vehicles]. Moscow, BMSTU Publ., 2001, 80 p.

[4] Kotiev G.O. *Prognozirovanie ekspluatatsionnykh svoystv system podressorivaniya voennykh gusenechnykh mashin.* Diss. dokt. tekhn. nauk [Prediction of operational properties of military tracked vehicle cushioning systems. Dr. Eng. Sci. Diss.]. Moscow, BMSTU Publ., 2000, 265 p.

[5] Sukhorukov A.V. *Upravlenie dempfiruyushchimi elementami v sisteme podressorivaniya bystrokhodnoy gusenichnoy mashiny.* Diss. cand. tekhn. nauk [Damping element control in the cushioning system of high-speed tracked vehicle. Cand. Eng. Sci. Diss.]. Moscow, 2003, 149 p.

[6] Furunzhiev R.I., Ostanin A.N. *Upravlenie kolebaniyami mnogoopornykh mashin* [Vibration control in multiple-seated machines]. Moscow, Mashinostroenie Publ., 1984, 206 p.

[7] Pozdeev A.V., Novikov V.V., Dyakov A.S., Pokhlebkin A.V., Ryabov I.M., Chernyshov K.V. *Reguliruemye pnevmaticheskie i pnevmogidravlicheskie ressory podvesok avtotransportnykh sredstv* [Adjustable pneumatic and hydropneumatic springs of vehicle suspensions]. Volgograd, Volgograd State technical University Publ., 2013, 244 p.

[8] *Simulink*. Available at: http://matlab.ru/products/simulink (accessed September 20, 2016).

[9] Tsipilev A.A. Issledovanie teplonagruzhennosti pnevmogidravlicheskikh ustroystv system podressorivaniya bystrokhodnykh transportnykh mashin [The research of heat load of cushioning system pneumatic/hydraulic devices of high-speed vehicles]. *Trudy NAMI* [Proceedings of NAMI]. Moscow, 2015, no. 261, pp. 151–172.

[10] Mikheev M.A., Mikheeva I.M. *Osnovy teploperedachi* [Fundamentals of heat transfer]. Moscow, Energiya Publ., 1977.

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