UDC 621.01.001.5

YSPOLZOVANYE FYLTRA FOR POVЫSHENYYA TOCHNOSTY YSSLEDOVANYY DYNAMYKY MOBYLNЫH MASHYN

M.P. Artiomov, doctor of technical sciences
M.L. Shulyak, candidate of technical sciences
Harkovskyy natsyonalnыy tehnycheskyy unyversytet selskoho hozyaystva ymeny Petra Vasylenko

In the state provedenы rezultatы yssledovanyy Po prymenenyyu fyltra for Kalmana povыshenyya tochnosty yssledovanyya dynamycheskyh and kvalymetrycheskyh parametrov mobylnыh mashyn in protsesse s эkspluatatsyy and vыpolnenyy ahrotehnycheskyh operatsyy.

Dynamycheskye and kvalymetrycheskye parametrы, adaptyvnыe filters, akselerometrы.

Production problems. Raznoobrazye tehnolohycheskyh trebovanyy, kotorыe predъyavlyayutsya for mashynno-traktornыm ahrehatam (MTA) vozmozhno vыrazyt sleduyuschymy obobschennыmy pokazatelyamy: proyzvodytelnostyu and ahrotehnycheskym kachestvom vыpolnyaemыh operatsyy at nyzkoy sebestoymosty s vыpolnenyya. Kontrol nad systemoy mashyn, kotorыe javljajutsja materyalno-tehnycheskoy bazoy kompleksnoy mehanyzatsyy proyzvodstvennoho tsykla and predstavlyayut soboy sovokupnost neskolkyh MTA, mashyn, mehanyzmov, kotorыe vzaymno dopolnyayut friend druha and pozvolyayut povыsyt эffektyvnost s yspolzovanyya [1]. In provedenyy dynamycheskyh yspytanyy MTA with yspolzovanyem akselerometrov voznykayut sluchaynыe and systemnыe pohreshnosty yzmerenyya lyneynыh uskorenyy.

Analyz poslednyh research. GOST 3310-96 [2], a takzhe HOST R 52302-2004 [3] predъyavlyayut dovolno zhestkye trebovanyya for tochnosty yzmerenyy at otsenke ustoychyvosty and upravlyaemosty mobylnыh mashyn in protsesse dorozhnыh yspytanyy. Trebovanyya for tochnosty yzmerenyy nekotorыh parametrov, kotorыe mozhno kontrolyrovat with pomoschyu mobylnoho rehystratsyonno-yzmerytelnoho kompleksa nA baze akselerometrov [4] pryvedenы in tabl. 1. Nekotorыe yssledovately ukazыvayut, what ye noise soderzhaschyysya in vыhodnom syhnale akselerometra, opredelyaet razreshayuschuyu sposobnost ustroystva, vazhnuyu at opredelenyy malыh uskorenyy. Predelnoe razreshenye in osnovnom

opredelyaetsya urovnem shuma yzmerenyya, kotorыy vklyuchaet vneshnyy fonovыy noise and noise sobstvenno datchyka. Umenshenye polosы propuskanyya putem vklyuchenyya LPF nA vыhode datchyka pryvodyt for snyzhenyyu urovnya shuma. That is uluchshaet otnoshenye syhnal / noise and uvelychyvaet razreshayuschuyu sposobnost, odnako vnosyt amplytudnыe and fazovыe chastotnыe yskazhenyya [5].

1. Trebovanyya for tochnosty yzmerenyy [2].

Yzmeryaemыe parametrы, edynytsы yzmerenyya	Dyapazon yzmerenyy	Oshybka, Nor bolee	
		absolyutnыh edynyts	otnosytelnыh edynyts (%)
Skorost TPA km / h	5-150	-	± 0,5
Uhlovaya skorost TPA, hradus / s	± 45	± 0,5	± 1,0
Bokovoe uskorenye, m / s2	± 7	± 0,15	± 1,0
Vremya, p	-	± 0,01	-
Temperatura, ° C	-	± 1,0	-

Esly yskazhenye syhnala yavlyaetsya yzvestnыm and ynvaryantnыm Po vremeny, tselesoobrazno prymenyat tradytsyonnыe metodы obrabotky syhnala [5]. And when yskazhenyya syhnala opysat zaranee Or nevozmozhno And they mohut menyatsya in protsesse snyatyya pokazanyy, tselesoobrazno prymenyat adaptyvnыe filters. Obobschennaya shema adaptyvnoho fyltra pryvedena nA Fig. 1.

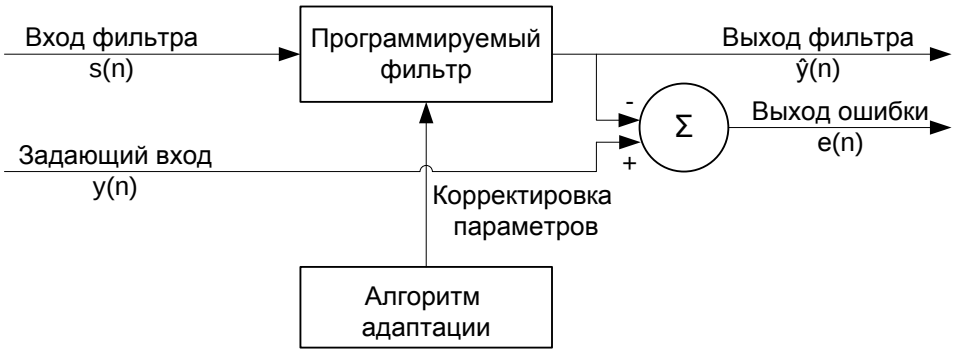

Fig. 1. Shema adaptyvnoho fyltra [5].

Filters for yspolzuyutsya propuskanyya syhnalov in nuzhnom dyapazone chastot and oslablenyya syhnalov vne эtoho dyapazona. klassyfykatsyya fyltrov in pervuyu ochered provodytsya Po-type amplytudno chastotnыh harakterystyk (ACHH) fyltrov series chastot (LPF) verhnyh chastot (HPF) polosno-propuskayuscheho fyltra (PPF) and polosno-zahrazhdayuscheho (rezhektornoho) fyltra (NRF).

Tsel yssledovanyy. Osnovnoy zadachey yssledovanyya yavlyaetsya poysk and razrabotka эffektyvnoy metodyky fyltratsyy syhnalov, poluchennыh is from akselerometrov kontrolno-yzmerytelnoho kompleksa at provedenyy эksperymentalnoy otsenky эkspluatatsyonnыh svoystv mobylnыh mashyn.

Rezultaty yssledovanyy. Esly rassmatryvat mobylnuyu mashynu - MTA, even as mehanycheskuyu systemu, kotoraya vыpolnyaet ahrotehnycheskuyu operatsyyu and vnachale ona nahodytsya in tochke 0 Nr pod deystvyem opredelennыh forces ahrehatu soobschaetsya nekotoroe uskorenye. In protsesse rabotы We provodym yzmerenye uskorenyy with shahom Δt sekund, kontrolyruya sostoyanye ahrehata.

Kryteryem optymalnosty prynyato schytat obespechenye maksymuma otnoshenyya syhnal noise. That is trebovanye pryvodyt for vыboru takoy formы chastotnoho koэffytsyenta peredachy fyltra, kotoraya obespechyvaet maksymum otnoshenyya syhnal noise nA His vыhode. For poluchenyya bolee tochnoy ynformatsyy in reshenyy эtoy zadachy yspolzuem filter Kalmana.

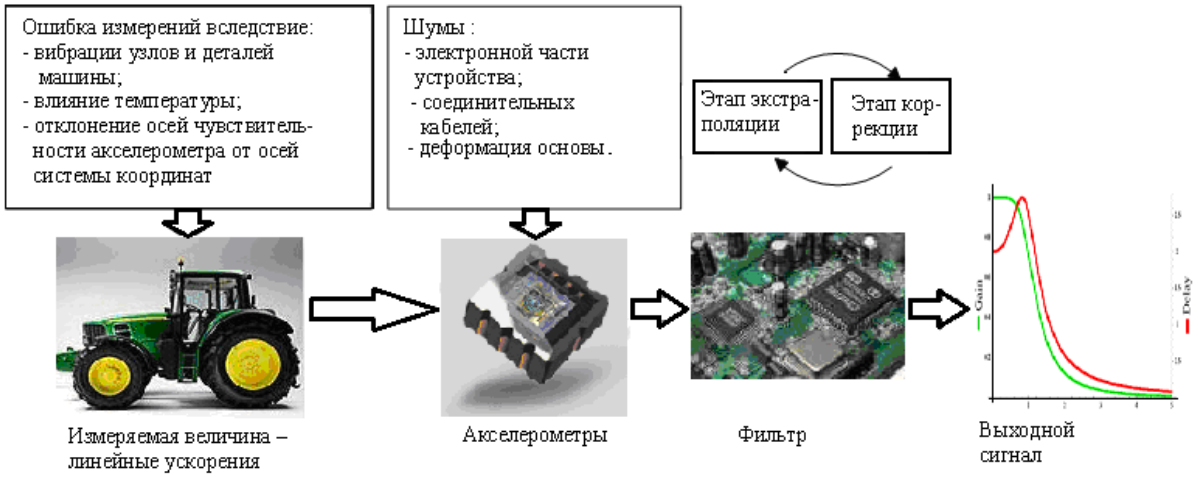

Fig. 2. Shema zamera lyneynыh uskorenyy MTA with yspolzovanyem fyltra.

Filter Kalmana yspolzuet dynamycheskuyu model systemы (naprymer, fyzycheskyy zakon dvyzhenyya) yzvestnыe upravlyayuschye vozdeystvyya and mnozhestvo posledovatelnыh yzmerenyy for formyrovanyya optymalnoy otsenky sostoyanyya. Alhorytm sostoyt IZ two povtoryayuschyhsya faz: эkstrapolyatsyya (predskazanye) and korrektyrovka. NA pervom эtape rasschytыvaetsya predskazanye sostoyanyya in sleduyuschyy moment vremeny (c uchetom netochnosty yzmerenyya s). NA vtorom, novaya ynformatsyya with datchyka korrektyruet predskazannoe znachenye (s takzhe uchetom netochnosty and zashumlennosty эtoy ynformatsyy) [6].

Budem schytat, what ye mezhdu $t-1$-m and t-m zameramy ahrehat dvyhaetsya with uskorenyem $\dot{V}_t$, Kotoroe raspredelyaetsya Po normalnomu zakonu with nulevым matematycheskym ozhydanyem and srednekvadratycheskym otklonenyem σa. Vospolzuemsya zakonom mehanyky Nyutona and zapyshem:

$$x_t = Fx_{t-1} + G\dot{V}_t \quad (1)$$

hde: G - Sluchaynыe vozdeystvyya nA ahrehat.

Kovaryatsyonnaya matrytsa sluchaynыh vozdeystvyy in protsesse raboty ahrehata mozhet byt zapysana in vyde:

$$Q = \mathrm{cov}(G\dot{V}) = E\left[(G\dot{V})(G\dot{V})^T\right] = GE\left[\dot{V}^2\right]G^T = G\left[\sigma_a^2\right]G^T = \sigma_a^2 GG^T, \quad (2)$$

hde: E - Matematycheskoe ozhydanye; σ_a - Skalyar.

NA kazhdom эtape raboty provodyatsya zamerы sostoyanyya ahrehata and esly dopustyt, what ye oshybka yzmerenyy μ_t otvechaet ranee vыskazannym trebovanyyam, verily kovaryatsyonnaya matrytsa shuma yzmerenyy budet ymet type [7]

$$R = E\left[\mu_t\ \mu_t^T\right] = \left[\sigma_a^2\right]. \quad (3)$$

In yspolzovanyy fyltra Kalmana His alhorytm ymeet opredelennыe slozhnosty with raschetnoy realyzatsyey, poэtomu luchshe yspolzovat razrabotannoe prohrammnoe obespechenye Visual Kalman Filter kompanyy HAN Software [8].

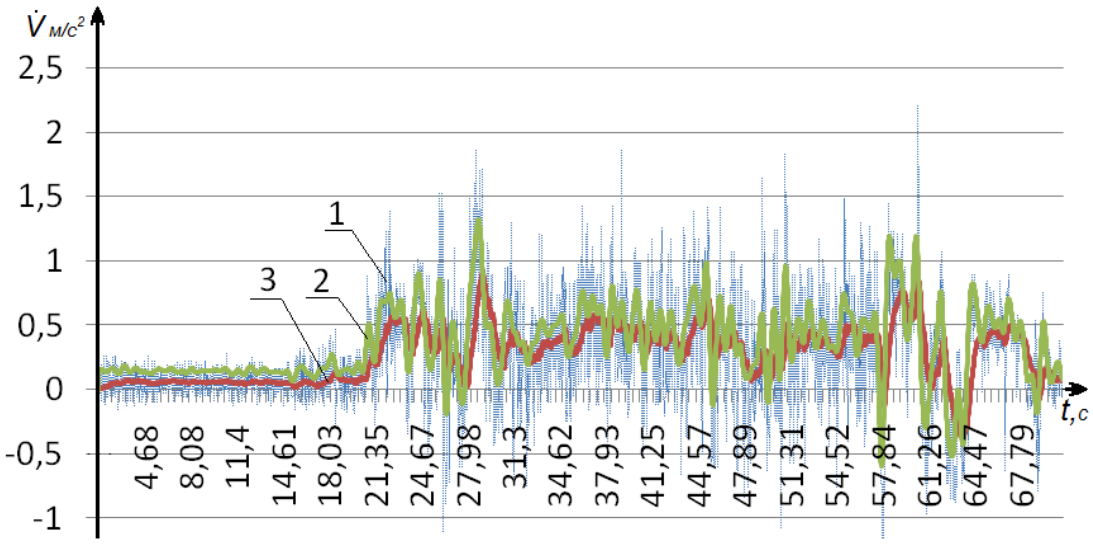

Fig. 3. Yzmenenye uskorenyy $\dot{V}$ at razlychnыh rezhymah dvyzhenyya ahrehata MTZ-80 + PLN-3-35 (udelnoe soprotyvlenye pochvы 9,5kN / m): 1 - massyv dannыh Nor proshedshyh filter; 2 - syhnal, proshedshyy filter Battervorta; 3 - syhnal, proshedshyy filter Kalmana.

Proanalyzyrovav rezultaty Po Figure 3 pryhodym for vыvodu, what ye opredelenye uskorenyy mobylnoho ahrehata bez yspolzovanyya

fyltratsyy in a case nekotorыh daet rasseyvanye rezultata is from 0.1M / s2 till the 0,8m / s2.

Provedennaya fyltratsyya with pomoschyu LPF rezultatov yspытanyy traktora MTZ-80, Po metodyke, prednaznachennoy for avtomobylnoho transporta, pozvolyla povыsyt tochnost эksperymentalnoy otsenky эkspluatatsyonnыh svoystv.

Vыvod. Yspolzovanye mobylnoho rehystratsyonno-yzmerytelnoho kompleksa nA baze akselerometrov MMA7260QT with prohrammnым obespechenyem Visual Kalman Filter pozvolyaet mynymyzyrovat dyspersyyu poluchennыh syhnalov. Skincare schet shlazhyvanyya shumov raznoy fyzycheskoy pryrodы dostyhaetsya povыshenye tochnosty эksperymentalnoy otsenky эkspluatatsyonnыh harakterystyk mashynno-traktornыh ahrehatov. Yspolzovanye, predlozhennoho fyltra in yssledovanyyah praktychesky Nor vlyyaet nA srednee znachenye syhnala. That is daet vozmozhnost realyzovыvat vozmozhnosty Effect nA upravlyaemost and ustoychyvost ahrehatov.

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Dynamycheskye and kvalymetrycheskye parametrы, adaptyvnыe filters, akselerometrы.

The paper investigated on the application of the Kalman filter to enhance the quality the study of the dynamics of mobile machines during their exploitation and implementation of farming operations.

Dynamic and qualitative parameters, adaptive filters, accelerometers.

UDC 621.9.048.7:621.373.826:631.31

Depth and microhardness CONSOLIDATED LASER LAYER FOR INCREASING STEEL 65G wear resistance Soil OF MACHINES

YO Kovalchuk, VV Didur, AV Nevzorov,
Candidates of Science
Uman National University of Horticulture

The analysis, which type of steel producers operating tillage machines used in Ukraine. The properties of the steel due to the laser and the feasibility of strengthening to further increase the durability of appropriate tools various additional measures to ensure the effective implementation of the method of surface laser processing in manufacturing.

The method of surface laser treatment, laser hardening, hardening, welding, wear-resistant carbide powders, steel 65G, working bodies tillage tools.

Formulation of the problem. Before tillage machinery manufacturers one of the priority tasks is to ensure high durability of areas of work that are most exposed to wear. As a result of abrasive wear of working surfaces is a loss of the original form of cutting elements, which increases traction resistance tillage machines and the cost of fuel and lubricants. Also there is a need sharpening or replacing damaged parts.

To strengthen the work of tillage machines method can be successfully applied surface laser treatment. Standing task analysis of laser treatment on the characteristics of steel used in Ukraine relevant manufacturers for the manufacture of such workers as Ploughshares, disc harrows, cultivators, etc. paws. You should also explore the