

ADSTAR

Author keywords  
1 of 1

Indexed keywords  
Download Print Save to PDF

SciVal Topics

Document type  
Conference Paper

Source type  
Conference Proceedings

ISBN  
979-835035978-7

DOI  
10.1109/MEES61502.2023.10402401

Publisher  
Institute of Electrical and Electronics Engineers Inc.

Original language  
English

View less

**Proceedings of the 5th International Conference on Modern Electrical and Energy System, MEES 2023** - 2023 - 5th IEEE International Conference on Modern Electrical and Energy System, MEES 2023 - Kremenchuk - 27 September 2023 through 30 September 2023 - Code 196931

## Development and Research of an Automatic System for Regulating the Frequency of Rotation of a Diesel Engine Crankshaft

Marchenko, Dmytro<sup>a</sup>; Matyeyeva, Kateryna<sup>b</sup>

Save all to author list

<sup>a</sup> Mykolajiv National Agrarian University, Maintenance and Servicing of Engineering and Energy Faculty, Department of Tractors and Agricultural Machines, Mykolajiv, Ukraine

<sup>b</sup> Mykolajiv National Agrarian University, Department of Foreign Languages of Faculty of Culture and Education, Mykolajiv, Ukraine

Full text options Export

### Abstract

The article is in an experimental model of an all-mode MR with PID regulation and electromechanical VM, providing a torque of 1.4 Nm at 36° of shaft rotation and without a gearbox. The minimum the ADCs of number and digital inputs of the microprocessor unit has been wired - at least 4 digital and 4 analog inputs. An algorithm has been developed for calculating the cyclic fuel supply with all-mode adjustment for a mathematical model of an electronic ARCH diesel engine with all-mode adjustment, taking into account the dynamic simulation of the CM, a sub-algorithm for regulating the fuel cyclic supply, maintaining the tilt angle of the regulatory branch and reproducing the influence of diesel vibrations. The adequacy of the mathematical model in statics and dynamics is confirmed. An experimental-computational research methodology has been developed to determine rational PID parameters, taking into account operating conditions of tractor diesel engine, confirmed by non-motorized and motorized studies on an engine diesel 4CHN12/14. The result of the study was a three-dimensional array of values of the proposed complex correction factor K<sub>Σ</sub> for PID MR components. In the process of research, an increase in diesel vibrations at crankshaft speeds n = 0.9...1.06 was established. With these values (n = 0.9...1.06), an increase in the P share is necessary to ensure diesel stability. For a 4CHN12/14 diesel engine, the share of P must be increased by 2...2.5 times with a degree of regulator unevenness of 0...0.6%. After non-motorized tests, it is recommended to correct the PID components on a engine diesel in the ranges n = 0.5...0.9 and 0.9...1.06 relative speeds. The crankshaft by reducing the proposed complex correction factor K<sub>Σ</sub> from 5% to 2% each. The developed method for setting PID parameters is confirmed by the results of test roads. It is determined that the increase in fuel consumption with an increase in external vibrations is non-linear. With external vibrations of the HPPF rails with an amplitude of 1...3 mm, a decrease in the I-component leads to reduced consumption fuel. Based on the results of modeling transient processes, a fuel saving of 2.25% was obtained. The developed all-mode controller corresponds to the first class of ARCH accuracy. © 2023 IEEE.

### Author keywords

diesel engine; frequency; fuel efficiency; proportional integral differential control; speed controller; vibration effect

### Indexed keywords

#### Engineering controlled terms

Controllers; Crankshafts; Proportional control systems; Two term control systems

#### Engineering uncontrolled terms

Automatic systems; Correction factors; Engine crankshafts; External vibrations; Frequency; Fuel efficiency; PID parameters; Proportional integral differential control; Speed controller; Vibration effect

#### Engineering main heading

Diesel engines

### SciVal Topics

No SciVal Topics found for this document.

### References (24)

View in search results format

All Export Print E-mail Save to PDF Create bibliography

- Zhou, Y., Liu, Q., Wang, M., Zhang, C.  
**Design of the control circuit used in variable speed diesel generator set** (Open Access)  
(2015) *Proceedings of 2015 IEEE Advanced Information Technology, Electronic and Automation Control Conference, IAEC 2015*, art. no. 7428640, pp. 676-680. Cited 2 times.  
ISBN: 978-147991979-6  
doi: 10.1109/IAEC.2015.7428640  
View at Publisher
- Lawan, M.M.G., Camara, M.B., Raharjaona, J., Dakyo, B.  
**Wind turbine and Batteries with Variable Speed Diesel Generator for Micro-grid Applications**  
(2018) *7th International IEEE Conference on Renewable Energy Research and Applications, ICRERA 2018*, art. no. 8566812, pp. 897-901. Cited 7 times.  
<http://ieeexplore.ieee.org/xpl/mostRecentIssue.jsp?anznumber=8540960>  
ISBN: 978-153865982-3  
doi: 10.1109/ICRERA.2018.8566812  
View at Publisher
- Kimura, M., Koharagi, H., Imaie, K., Dodo, S., Arita, H., Tsubouchi, K.  
**A permanent magnet synchronous generator with variable speed input for co-generation system**  
(2001) *Proceedings of the IEEE Power Engineering Society Transmission and Distribution Conference, 3 (WINTER MEETING)*, pp. 1419-1424. Cited 10 times.  
View at Publisher
- Gosala, D.B., Allen, C.M., Ramesh, A.K., Shaver, G.M., McCarthy, J., Stretch, D., Koerberlein, E., (...), Farrell, L.  
**Cylinder deactivation during dynamic diesel engine operation**  
(2017) *International Journal of Engine Research*, 18 (10), pp. 991-1004. Cited 36 times.  
<http://ier.sagepub.com/content/17/year>  
doi: 10.1177/1468087417694000  
View at Publisher
- Iglesias, I.J., García-Tabarés, L., Agudo, A., Cruz, I., Arribas, L.  
**Design and simulation of a stand-alone wind-diesel generator with a flywheel energy storage system to supply the required active and reactive power**  
(2000) *PESC Record - IEEE Annual Power Electronics Specialists Conference*, 3, pp. 1381-1386. Cited 59 times.  
doi: 10.1109/PESC.2000.880510  
View at Publisher
- Sebastian, R., Pena-Alzola, R., Quesada, J.  
**Simulation of a wind diesel power system with flywheel energy storage**  
(2017) *IEEE International Symposium on Industrial Electronics*, art. no. 8001584, pp. 2115-2120. Cited 5 times.  
ISBN: 978-150901412-5  
doi: 10.1109/ISIE.2017.8001584  
View at Publisher
- Barakat, A., Tnani, S., Champenois, G., Mouni, E.  
**Analysis of synchronous machine modeling for simulation and industrial applications**  
(2010) *Simulation Modelling Practice and Theory*, 18 (9), pp. 1382-1396. Cited 42 times.  
doi: 10.1016/j.simpat.2010.05.019  
View at Publisher
- López, J.D., Espinosa, J.J., Agudelo, J.R.  
**LQR control for speed and torque of internal combustion engines**  
(2011) *IFAC Proceedings Volumes (IFAC-PapersOnline)*, 44 (1 PART 1), pp. 2230-2235. Cited 19 times.  
<http://www.ifac-papersonline.net/browse?browse=>  
ISBN: 978-390266193-7  
doi: 10.3182/20110828-6-IT-1002.02176  
View at Publisher
- Dong, T., Zhang, F., Liu, B., An, X.  
**Model-Based state feedback controller design for a turbocharged diesel engine with an EGR system**  
(2015) *Energies*, 8 (6), pp. 5018-5039. Cited 11 times.  
<http://www.mdpi.com/1996-1073/8/6/5018/pdf>  
doi: 10.3390/en8065018  
View at Publisher
- Simani, S., Bonfè, M.  
**Fuzzy modelling and control of the air system of a diesel engine** (Open Access)  
(2009) *Advances in Fuzzy Systems*, art. no. 450259. Cited 13 times.  
doi: 10.1155/2009/450259  
View at Publisher
- Karabektas, M., Ergen, G., Hosoz, M.  
**The effects of preheated cottonseed oil methyl ester on the performance and exhaust emissions of a diesel engine**  
(2008) *Applied Thermal Engineering*, 28 (17-18), pp. 2136-2143. Cited 130 times.  
doi: 10.1016/j.applthermaleng.2007.12.016  
View at Publisher
- Karimi, E., Kazerani, M.  
**Impact of renewable energy deployment in Canada's remote communities on diesel generation carbon footprint reduction** (Open Access)  
(2017) *Canadian Conference on Electrical and Computer Engineering*, art. no. 7946740. Cited 2 times.  
<http://ieeexplore.ieee.org/xpl/conhome.jsp?anznumber=1000225>  
ISBN: 978-150905538-8  
doi: 10.1109/CCCE.2017.7946740  
View at Publisher
- Nejabatkhah, F.  
**Optimal Design and Operation of a Remote Hybrid Microgrid**  
(2018) *CPS Transactions on Power Electronics and Applications*, 3, pp. 3-13. Cited 38 times.  
<https://doi.org/10.24795/CPSSTPEA.2018.00001>
- Benhamed, S., Ibrahim, H., Belmokhtar, K., Hosni, H., Illica, A., Rousse, D., Chandra, A., (...), Ramdenee, D.  
**Dynamic modeling of diesel generator based on electrical and mechanical aspects**  
(2016) *2016 IEEE Electrical Power and Energy Conference, EPEC 2016*, art. no. 7771756. Cited 26 times.  
ISBN: 978-150901919-9  
doi: 10.1109/EPEC.2016.7771756  
View at Publisher
- Rezkallah, M., Chandra, A., Rousse, D.R., Ibrahim, H., Illica, A., Ramdenee, D.  
**Control of small-scale wind/diesel/battery hybrid standalone power generation system based on fixed speed generators for remote areas**  
(2016) *IECON Proceedings (Industrial Electronics Conference)*, art. no. 7793057, pp. 4060-4065. Cited 8 times.  
ISBN: 978-150903474-1  
doi: 10.1109/IECON.2016.7793057  
View at Publisher
- Bui, M.X., Guan, D., Xiao, D., Rahman, M.F.  
**A Modified Sensorless Control Scheme for Interior Permanent Magnet Synchronous Motor over Zero to Rated Speed Range Using Current Derivative Measurements**  
(2019) *IEEE Transactions on Industrial Electronics*, 66 (1), art. no. 8331900, pp. 102-113. Cited 37 times.  
<http://ieeexplore.ieee.org/xpl/tocresult.jsp?anznumber=5410131>  
doi: 10.1109/TIE.2018.2823663  
View at Publisher
- Fonte, M., Duarte, P., Anes, V., Freitas, M., Reis, L.  
**On the assessment of fatigue life of marine diesel engine crankshafts**  
(2015) *Engineering Failure Analysis*, 56, pp. 51-57. Cited 51 times.  
doi: 10.1016/j.engfailanal.2015.04.014  
View at Publisher
- Payo, I., Sánchez, L., Caño, E., Armas, O.  
**Control applied to a reciprocating internal combustion engine test bench under transient operation: Impact on engine performance and pollutant emissions** (Open Access)  
(2017) *Energies*, 10 (11), art. no. 1690. Cited 6 times.  
<http://www.mdpi.com/1996-1073/10/11/1690/pdf>  
doi: 10.3390/en10111690  
View at Publisher
- Dong, T., Zhang, F., Liu, B., An, X.  
**Model-Based state feedback controller design for a turbocharged diesel engine with an EGR system**  
(2015) *Energies*, 8 (6), pp. 5018-5039. Cited 11 times.  
<http://www.mdpi.com/1996-1073/8/6/5018/pdf>  
doi: 10.3390/en8065018  
View at Publisher
- Marchenko, D., Dykha, A., Aulin, V., Matyeyeva, K., Tishechkina, K., Kurepin, V.  
**Development of Technology and Research of Method of Electric Hydropulse Hardening of Machine Parts**  
(2020) *Proceedings of the 25th IEEE International Conference on Electric Drive. Theory and Practice, PAEP 2020*, art. no. 9240796. Cited 5 times.  
<http://ieeexplore.ieee.org/xpl/mostRecentIssue.jsp?anznumber=9240771>  
ISBN: 978-172819935-1  
doi: 10.1109/PAEP49887.2020.9240796  
View at Publisher
- Marchenko, D., Matyeyeva, K., Kurepin, V.  
**Development of Methods for Digital Diagnostics of Engines by Electronic Indication**  
(2022) *Proceedings of the 2022 IEEE 4th International Conference on Modern Electrical and Energy System, MEES 2022*  
<http://ieeexplore.ieee.org/xpl/mostRecentIssue.jsp?anznumber=10005607>  
ISBN: 979-835034683-1  
doi: 10.1109/MEES58014.2022.10005758  
View at Publisher
- Lymar, O., Marchenko, D.  
**Promars for the Application of Restoring Electric Arc Coatings in the Repair of Machines and Mechanisms**  
(2022) *Proceedings of the 2022 IEEE 4th International Conference on Modern Electrical and Energy System, MEES 2022*  
<http://ieeexplore.ieee.org/xpl/mostRecentIssue.jsp?anznumber=10005607>  
ISBN: 979-835034683-1  
doi: 10.1109/MEES58014.2022.10005709  
View at Publisher
- Marchenko, D., Dykha, A., Matyeyeva, K., Kurepin, V.  
**Research of Electric Contact Welding by a Wire at Restoration of Details of Cars**  
(2021) *Proceedings of the 20th IEEE International Conference on Modern Electrical and Energy Systems, MEES 2021*  
<http://ieeexplore.ieee.org/xpl/mostRecentIssue.jsp?anznumber=9598465>  
ISBN: 978-166542366-3  
doi: 10.1109/MEES52427.2021.9598465  
View at Publisher
- Marchenko, D., Kurepin, V.  
**Regularities In The Formation Of Wear-Resistant Coatings On Steel Samples When Machining Them With Electrical Discharge**  
(2021) *Eastern - European Journal of Enterprise Technologies*, 5 (12-113), pp. 83-90.  
<https://journals.urau.ua/eejet/>  
doi: 10.15587/1729-4061.2021.243374  
View at Publisher

Marchenko, D.; Mykolajiv National Agrarian University, Maintenance and Servicing of Engineering and Energy Faculty, Department of Tractors and Agricultural Machines, Mykolajiv, Ukraine; email:marchenkodd@mnau.edu.ua

© Copyright 2024 Elsevier B.V., All rights reserved.

Cited by 0 documents

Inform me when this document is cited in Scopus:

Set citation alert

### Related documents

Formation and Study of Static and Dynamic Characteristics of Electronically Controlled Diesel Engine

Dumenko, P., Kravchenko, S., Prokhorenko, A. (2019) *Latvian Journal of Physics and Technical Sciences*

Development of an Electropneumatic Vehicle Brake Drive

Marchenko, D., Dykha, A., Matyeyeva, K. (2023) *Proceedings of the 5th International Conference on Modern Electrical and Energy System, MEES 2023*

Variable Speed Diesel Generators: Performance and Characteristic Comparison

Moharrar, M., Rezkallah, M., Illica, A. (2022) *Energies*

View all related documents based on references

Find more related documents in Scopus based on:

Authors Keywords