3. Фельдман М.Г. Влияние низкоинтенсивного инфракрасного лазерного излучения на рост и развитие гидробионтов: автореф. Дис. На получ. Науч. Степени канд. Биол. Наук: спец. 03.00.18 «Гидробиология» / М.Г. Фельдман; Моск. Гос. Технол. Академия. – М., 2003. – 110 с.
4. Туркин А. Н. Применение светодиодов в светотехнических решениях: история, реальность и перспективы / А. Н.Туркин // Современные технологии автоматизации; «СТА-ПРЕСС» М. 2011. - №2.- С. 6-21.

UDC 681.518

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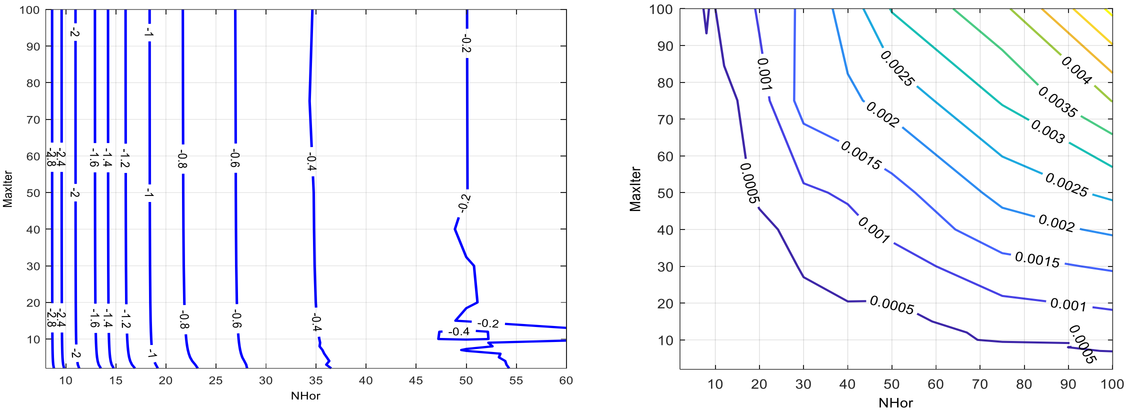
PREDICTIVE ROTOR FLUX CONTROL FOR EFFICIENT DYNAMIC OPERATION OF INDUCTION MACHINES

Autonomous driving electric vehicles will require energy-efficient and cost-effective electric drives. The main task of the control system is to secure the required torque. With a field-orientation induction machine drive, the torque T_e depends on the number of pole pairs Z_p, the q-axes stator current I_{1q}, and the rotor flux linkage Ψ_2. There are two degrees of freedom to adjust the output. The simplest way is to keep the rotor flux constant and alter the stator current in the steady-state [1]. However, the dynamic optimization problem is more complicated since the vehicle's electric drive constantly changes its operating conditions in real road traffic. The sub-optimal online method is discussed in [2], but it is applicable only in the restricted domain of operation. Thus, it makes sense to use predictive control methods. The current paper extends the data from [3], with information about the computation time, the accuracy of predicted rotor flux trajectory, as well as the total energy saved over the cycle (Figure 1).



a) deviation of the predicted trajectory, % b) computation time, sec

Fig. 1 – Impact of algorithm parameters: MaxIter – iterations, Nhor – number of intervals

Utilizing the numerical taxonomy, it is shown that the number of iterative steps to locate the acceptable value of the point on the trajectory of transferring the electromechanical system from the current state to the new state, determined by augmented GRAMPC, ranges from 2 to 3 provided the number of intervals on the forecast horizon from 9 to 50 providing an error value of 2.7% to 0.2% regarding the desired trajectory of the electric drive in the real-time while maintaining its efficiency with a sampling interval of 1.0e-3 sec.

REFERENCES

[1] Windisch, T. & Hofmann, W. (2018). A novel approach to MTPA tracking control of AC drives in vehicle propulsion systems. *IEEE Transactions on Vehicular Technology*, *67*(10), 9294-9302. DOI: 10.1109/TVT.2018.2861083

[2] Grăcar, B., Hofer, A. & Štumberger, G. (2020). Induction machine control for a wide range of drive requirements. *Energies*, *13*(1), 175. DOI: 10.3390/en13010175

[3] Diachenko, G. G. & Aziukovskyi, O. O. (2017). Investigation of the process parameters influence on the energy efficiency of an induction motor under model predictive control GRAMPC. *Mechanics, Materials Science & Engineering*, *12*, 1-8. DOI: 10.2412/mmse.5.86.76