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Izvorni znanstveni članak

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ROBUSNI SUSTAV UPRAVLJANJA GIBANJEM PREKO KOMUNIKACIJSKE MREŽE ZASNOVAN NA REKONSTRUKCIJI POREMEĆAJA

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Cilj je ovoga članka realizacija sustava upravljanja gibanjem preko komunikacijske mreže. Jedan od najvećih problema u realizaciji sustava upravljanja gibanjem preko komunikacijske mreže jest kašnjenje u prijenosu podataka. To kašnjenje dovodi do narušavanja svojstava sustava upravljanja gibanjem, a može ga učiniti i nestabilnim. Za kompenzaciju kašnjenja u radu se predlaže modificirani rekonstruktor poremećaja zasnovan na Smithovu prediktoru. Predloženi rekonstruktor omogućuje izvedbu robusnog sustava upravljanja gibanjem s dva stupnja slobode. Valjanost predloženog sustava potvrđena je eksperimentalno na sustavu upravljanja pozicijom linearnog motora preko komunikacijske mreže. Dobiveni rezultati pokazuju robusno vladanje predloženog sustava u uvjetima promjenjivog kašnjenja prijenosa podataka preko mreže i pri djelovanju vanjske sile.

(Sl. 11, Tab. 2, Lit. 12 – original na engleskom) *Autori*

upravljanje gibanjem
sustavi upravljanja preko mreže
rekonstrukcija signala
linearni motori

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PROJEKTIRANJE UPRAVLJANJA MEHATRONIČKOG SUSTAVA ZASNOVANO NA DINAMIČKOM OPONAŠANJU MEHANIČKOG TERETA

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U članku se opisuje i analizira brza metoda dinamičkog oponašanja mehaničkog tereta. Pristup se može primijeniti za projektiranje, testiranje i provjeru valjanosti mehatroničkog sustava upravljanog elektromotornim pogonom, te posebno za prototipna ispitivanja. Aktualni sustav (prototip) je zamijenjen elektromehaničkim teretom, koji je upravljan momentom. Potrebni moment se računa iz zatvorene regulacijske petlje. Aktivni teret je spojkom mehanički povezan s pogonskom osovinom. Prikazane su također moguće primjene u projektiranju sustava promjenjive brzine i momenta. Za ilustraciju metode oponašanja tereta prikazan je pumpni mehanizam.

(Sl. 17, Lit. 12 – original na engleskom) *Autori*

mehatronički sustav
projektiranje
dinamičko oponašanje
mehanički teret

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ALGORITAM ZA SPRJEČAVANJE ZASTOJA TEMELJEN NA UZASTOPNOJ KONTROLI SIFONA PETRIJEVE MREŽE

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Članak opisuje formalnu metodu proračuna nadzornika za sprječavanje zastoja korištenjem Petrijevih mreža. Predloženi algoritam koristi stablo dostupnih stanja za detekciju stanja zastoja i metodu uzastopne kontrole sifona za sintezu nadzornika za sprječavanje zastoja. Nadzornik je najviše dopuštajući i sadrži najmanji broj kontrolnih mjesta. Algoritam je namijenjen za reverzibilne ili djelomično reverzibilne P-T Petrijeve mreže, ali se može koristiti i za obične Petrijeve mreže. Proračun nadzornika pokazan je na dva primjera. Prvi primjer prikazuje sintezu nadzornika za sprječavanje zastoja u fleksibilnom proizvodnom sustavu s tri robota i tri proizvodne trake, gdje se zastoj može dogoditi zbog međusobnog natjecanja transportnih traka za angažiranjem robota te zbog nepredvidljivosti trajanja tih angažmana. Drugi primjer prikazuje sintezu nadzornika u pomorskom prometnom sustavu, gdje se opasne situacije zastoja plovila mogu dogoditi poradi neodgovarajućeg pomicanja plovila kroz sustav. Da bi se to izbjeglo, promet plovila se nadzire i upravlja pomoću svjetlosne signalizacije korištenjem nadzornika za sprječavanje zastoja, koji je odgovoran za zaustavljanje plovila samo u slučaju opasnog stanja te dok to stanje ne nestane.

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nadzornik za sprječavanje zastoja
Petrijeva mreža, kontrola sifona

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SMANJENJE GUBITAKA ISTITRAVANJA KOD NEIZRAVNOG ISTOSMJERNOG PRETVARAČA S TRANSFORMATOROM UPORABOM RC-RCD PRIGUŠNOG ČLANA

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Neizravni istosmjerni pretvarač s transformatorom jedan je od najpopularnijih istosmjernih pretvarača za izvore napajanja malih snaga. Zbog rasipnog induktiviteta transformatora tijekom rada pretvarača dolazi do pojave prenapona, koji se mogu ograničiti pomoću disipativnih RCD ili nedisipativnih LCD prigušnih sklopova. Oba prigušna sklopa sadrže diodu. Reverzni naboj oporavljanja diode uzrokuje oscilacije koje uzrokuju dodatne gubitke u prigušnom sklopu. Članak opisuje pojavu istitravanja i uporabu RC-RCD prigušnog sklopa za prigušenje oscilacija uzrokovanih prigušnom diodom. Opisani prigušni sklop omogućava povećanje djelotvornosti neizravnog istosmjernog pretvarača s transformatorom.

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gubici istitravanja
neizravni istosmjerni pretvarač s transformatorom
prigušni sklop

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MECHATRONIC SYSTEMS' CONTROL DEDSIGN USING DYNAMIC EMULATION OF MECHANICAL LOADS

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The paper presents and analyses rapid prototyping methods for the dynamic emulation of mechanical loads. Approaches can be applied in design, testing and validation of the mechatronic systems propelled by electric drives. Actual system (prototype) is replaced by the torque controlled electromechanical load, for which the required torque is calculated through the closed-loop control algorithm. The active load is connected mechanically to the drive shaft, using the clutch. Also possible applications in the control design for variable speed and torque drives are described. For the illustration of the method emulation of the pump mechanism is given.

(Fig. 17, Ref. 12 – original in English) *Authors*

mechatronic system
control design
dynamic emulation
mechanical load

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AUTOMATIKA 47(1–2),5–10(2006)

ROBUST NETWORK MOTION CONTROL SYSTEM BASED ON DISTURBANCE OBSERVER

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The aim of this paper is to realize robust network motion control system. One of the most significant issues for network motion control realization is time delay during transmission. Obviously, most time delay systems are unstable. Additionally, time delay may cause control performance degradation in motion control system. In this paper, a modified disturbance observer with Smith predictor is proposed to compensate time delay. This modification realizes a robust two-degree-of-freedom control system ower network. The serial compensation of Smith predictor is utilized to compensate time delay. The validity of the proposed method is confirmed by the position control of linear motor over network experimentally. Experimental results show that the proposed control system has robustness against transmission delay fluctuation over network and external force.

(Fig. 11, Tab. 2, Ref. 12 – original in English) *Authors*

motion control
network control systems
observers
linear motors

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AUTOMATIKA 47(1–2),31–37(2006)

REDUCTION OF RINGING LOSSES IN FLYBACK CONVERTER BY USING THE RC-RCD CLAMP CIRCUIT

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Flyback converter is one of the most popular DC-DC converters for low power supply. Due to the transformer leakage inductance the converter suffers from the voltage spikes, which can be »controlled« by the dissipative RCD or non-dissipative LCD clamp circuits. Both of the clamp circuits consist of the diode. The diode reverse recovery charge causes the oscillation, which results in additional dissipation of the clamp circuitry. This paper describes this ringing phenomenon and the use of an RC-RCD clamp circuit for damping the clamp-diode's oscillation. This clamp circuit is capable for improving a flyback converter's power ratio.

(Fig. 17, Ref. 6 – original in English) *Authors*

clamp circuit
flyback converter
ringing losses

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Original scientific paper

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AN ALGORITHM FOR DEADLOCK PREVENTION BASED ON ITERATIVE SIPHON CONTROL OF PETRI NET

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This paper presents a formal calculation method of a deadlock prevention supervisor by the use of Petri nets. The proposed algorithm uses reachability tree to detect deadlock state and iterative siphon control method to synthesize the deadlock prevention supervisor. Such supervisor is maximally permissive and consists of minimal number of control places. The algorithm is intended for reversible or partially reversible P-T Petri net, but it can also be applied to Ordinary Petri nets. The calculation of the supervisor is illustrated by two examples. The first example shows the synthesis of deadlock prevention supervisor in a manufacturing system consisting of three conveyors and three robots, where the deadlock can occur due to concurrent requests of the conveyors for the robot engagements and unpredictable duration of those engagements. The second example shows the synthesis of deadlock prevention supervisor in a marine traffic system, where dangerous vessel deadlock situations may occur in case of vessels' irregular motion through the system. To avoid this, the vessel traffic is supervised and controlled by traffic lights using the deadlock prevention supervisor, which is responsible for vessels' stopping only in the case of dangerous situation and until this situation elapses.

(Fig. 10, Tab. 2, Ref. 9 – original in English) *Authors*

deadlock prevention supervisor
Petri net, siphon control

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Stručni članak

AUTOMATIKA 47(1–2), 39–48(2006)

UPRAVLJANJE SUSTAVOM LONGITUDINALNE VENTILACIJE CESTOVNOG TUNELA ZASNOVANO NA NEIZRAZITOJ LOGICI S PREDIKTIVNIM MODELOM

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U ovom članku opisana je metoda upravljanja sustavom longitudinalne ventilacije cestovnih tunela. Metoda se sastoji od dvije glavne cjeline: a) predikcije potrebnog broja aktivnih ventilatora; i b) neizrazitog upravljanja razinom zagađenja zraka u tunelu. Na osnovi mjerenja vremenskih uvjeta i intenziteta prometa kroz tunel, te poznatih parametara tunela, obavlja se predikcija proizvodnje ugljičnog monoksida, dušikovih oksida i krutih čestica iz ispuha vozila. Te procijenjene količine zagađenja se u nastavku koriste za proračun zahtjeva za svježim zrakom, tj. potrebne brzine strujanja zraka kroz tunel. Broj ventilatora s ukupnim potiskom dovoljnim da se postigne to strujanje određuje se iz ravnoteže sila koje djeluju na zračnu masu u tunelu. Istodobno, neizraziti regulator uspoređuje mjerene i zadane vrijednosti zagađenja, te podešava proračunati broj ventilatora kako bi održao stupanj onečišćenja zraka unutar dopuštenih granica. Predložena metoda upravljanja ispitana je simulacijom uz usporedbu s metodom upravljanja koja je dosad korištena u tunelu Učka, a potom su dani rezultati stvarne implementacije predstavljene metode upravljanja na tunelu Učka.

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neizrazito upravljanje
prediktivno upravljanje
ventilacija tunela

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Izvorni znanstveni članak

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PONIŠTAVANJE AKUSTIČKE JEKE PRI »HANDS-FREE« KOMUNIKACIJI

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Kontrola akustičke povratne veze ima važnu ulogu u sustavima koji procesiraju govor, a pritom mikrofon prima audio signale reproducirane pomoću zvučnika kao i refleksije okolnog prostora. Korisnici su ometani pri slušanju jer čuju svoj vlastiti govor zbog vremenskog kašnjenja povratnog signala pri uporabi »hands-free« komunikatora. U članku su uspoređena konvergencijska svojstva dvaju adaptivnih algoritama za FIR filtre koji se upotrebljavaju u sustavima za potiskivanje odjeka. Osim osnovnih algoritama razmatrane su i naprednije verzije koje uključuju adaptivnu veličinu koraka.

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konvergencija
FIR filtar
ugađanje
poništenje jeke
povratna veza
LEM sustav

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Pregledni članak

AUTOMATIKA 47(1–2), 59–67(2006)

ADSL ANALOGNO SUČELJE

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U radu su opisane i uspoređene izvedbe ADSL analognog sučelja. Analogno sučelje kao dio ADSL modema najodgovornije je za kvalitetan prijenos signala preko telefonskih žica. Može se podijeliti u sklopove predajnog puta, prijamnog puta i hibridnu mrežu s transformatorom. Prikazan je rad i izvedbe svakog funkcijskog bloka. To su D/A pretvornik, filtar i izlazno pojačalo u predajnom putu te ulazno pojačalo, filtar i A/D pretvornik u prijamnom putu. Hibridna mreža i transformator prosljeđuju signale u oba smjera. Za praktičnu izvedbu AFE čipa koriste se razne tehnologije. Naznačene su smjernice daljnjeg razvoja.

(Sl. 9, Tab. 6, Lit. 39 – original na engleskom) *Autor*

analogni filtar
izlazno pojačalo
pretvornici signala
simetrična digitalna pretplatnička linija
širokopojasne komunikacije
žičani pristup

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Stručni članak

AUTOMATIKA 47(1–2), 69–74(2006)

STRATEGIJE KODIRANJA KOD UMJETNE PUŽNICE

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Primjena umjetne pužnice kao pomagala pri slušanju i govoru u gluhih osoba poznata je više od 25 godina. Ovaj članak uspoređuje 3 različite strategije kodiranja govora. To su MPEAK strategija kodiranja više vršnih vrijednosti, nova SPEAK strategija kodiranja spektralnih vršnih vrijednosti i CIS strategija kodiranja kontinuirano-proširenim uzorkovanje velike brzine. Rezultati raznih istraživanja ukazuju da SPEAK i CIS strategije kodiranja, zasnovane na analizi spektra signala, omogućavaju bolju razumljivost govora u uvjetima tišine kao i buke, nego MPEAK strategija kodiranja koja se zasniva na izdvajanju karakterističnih frekvencijskih područja za govor.

(Sl. 6, Lit. 4 – original na engleskom) *Autori*

CIS strategija kodiranja govora
MPEAK strategija kodiranja govora
SPEAK strategija kodiranja govora
umjetna pužnica

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AUTOMATIKA 47(1–2),49–58(2006)

THE ACOUSTIC ECHO CANCELLATION HANDS-FREE COMMUNICATOR

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The control of acoustic feedback has an important function in speech processing systems, whenever the microphone picks up the audio signal radiated by loudspeaker and its reflection from the enclosure. The users are annoyed by listening to their own speech delayed by the round-trip time of the hands free communicator. This paper compares convergence properties of two FIR filter adaptation algorithms used in echo cancellation. Beside base algorithms, advanced and improved versions that include adaptive step size are considered.

(Fig. 16, Ref. 6 – original in English) *Authors*

convergence
FIR filter
adaptation
echo cancellation
feedback
LEM system

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Professional paper

AUTOMATIKA 47(1–2), 39–48(2006)

MODEL PREDICTIVE FUZZY CONTROL OF LONGITUDINAL VENTILATION SYSTEM IN A ROAD TUNNEL

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In this paper we describe a control method for longitudinal ventilation of road tunnels. The method consists of two main elements: a) prediction of a number of jet fans and b) fuzzy control of pollutant levels. Based on measurements of traffic intensity and weather conditions and by knowing tunnel parameters, production of CO, NOx and small particles (soot) is predicted. Estimated values of pollutants are then used for calculation of fresh air volume demand, i.e. required air flow is determined. One dimensional force equation is used for estimation of a number of jet fans that would produce a thrust force sufficient to provide calculated air flow. In the same time a fuzzy controller compares measured and requested levels of pollutants and adjusts a predicted number of jet fans in order to keep the pollutant levels within predefined boundaries. The proposed method is tested by simulation and obtained results are compared with a method which was previosly used in the ventilation system of the tunnel Ucka. Finally, the field results from the proposed control method implementation in the tunel Ucka are presented.

(Fig. 18, Tab. 3, Ref. 7 – original in English) *Authors*

fuzzy control
predictive control
road tunnel ventilation

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CODING STRATEGIES FOR COCHLEAR IMPLANTS

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The application of cochlear implants in the correction of hearing and speech impediments in deaf persons is known more than 25 years. This paper compares 3 different speech-coding strategies. These are the multipeak (MPEAK) coding strategy, the new spectral-peak (SPEAK) coding strategy and the high-rate continuous interleaved sampling (CIS) coding strategy. Results of several investigations show that the SPEAK and CIS coding strategies, based on spectral signal analysis, allow for better speech understanding in quiet as well as in noise, than MPEAK coding strategy, which relays on speech feature extraction.

(Fig. 6, Ref. 4 – original in English) *Authors*

CIS speech-coding strategy
MPEAK speech-coding strategy
SPEAK speech-coding strategy
cochlear implant

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Review

AUTOMATIKA 47(1–2),59–67(2006)

ADSL ANALOG FRONT END

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In this paper the Asymmetric Digital Subscriber Line (ADSL) analog front end (AFE) designs are described and compared. AFE is the part of ADSL modems most responsible for quality signal transmission over phone wires. It can be divided into the transmitting path (TX) circuitry, the receiving path (RX) circuitry and the hybrid network and transformer. The operations and realizations of each functional block are presented. There are the D/A converter, the filter and the line driver in the TX path and the voltage gain amplifier, the filter and the A/D converter in the RX path. The hybrid network and transformer process signals in both directions. Different fabrication technologies are used for the practical realizations of the AFE chip. The directions of the further developing are notified.

(Fig. 9, Tab. 6, Ref. 39 – original in English) *Author*

analog filter
asymmetric digital subscriber line
broadband communications
data converters
line driver
wireline access

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