

## THEORETICAL AND EXPERIMENTAL RESEARCH OF THE DYNAMIC PROCESS OF THE GEARSHIFT CONTROL IN THE PLANETARY GEARBOX

UDC: 621.833.65

The most important parameters, which characterize the period of synchronization, were determined in this paper by using a mathematical model applied on the planetary gear train (Ravigneaux type) of the component gearbox for the gear shift without the power flow interruption. These parameters are the following:

- angular velocities and accelerations of the rotating parts,
- torque of the output shaft of the gear train and
- the duration of the dynamic process.

The theoretical results are then compared with the experimental results obtained on the test stand.

Matching the theoretical and experimental results, it was shown that the most important parameters of the dynamic process can be determined in the design phase of the gearbox and the control system by the use of an adequate mathematical model. In order to obtain an optimal dynamic process, the model offers a possibility of detailed analyses of the influence of most important factors on the values of these parameters. It is possible on such a way to view the effects which exist in the complex process of gear shift without the power flow interruption, as early as the development stage.

*Keywords: planetary gearbox, gear shift control, dynamic process, period of synchronization.*

### TEORIJSKO I EKSPERIMENTALNO ISTRAŽIVANJE DINAMIČKOG PROCESA PRI PROMENI STEPENA PRENOSA U PLANETARNOM MENJAČU

U ovom radu se pomoću matematičkog modela na karakterističnom planetarnom sklopu (tipa RAVIGNEAUX) složenog menjačkog prenosa, u okviru promene stepena prenosa bez prekida toka snage, određuju najvažniji parametri dinamičkog procesa koji karakterišu period sinhronizacije, a to su:

- ugaone brzine i ubrzanja rotirajućih elemenata,
- obrtni moment na izlaznom vratilu prenosa i
- vreme trajanja dinamičkog procesa.

Rezultati se potom upoređuju sa eksperimentalnim, dobijenim na probnom stolu. Podudarnost teorijskih i eksperimentalnih rezultata pokazuje, da se pomoću odgovarajućeg matematičkog modela mogu još u fazi projektovanja menjača i sistema za upravljanje, odrediti najvažniji parametri dinamičkog procesa. Model pruža i mogućnost sprovođenja detaljne analize najuticajnijih faktora na veličinu ovih parametara u cilju dobijanja optimalnog dinamičkog procesa. Na taj način se i bez ispitivanja još u fazi razvoja menjača mogu sagledati efekti koji proističu iz složenog procesa promene stepena prenosa bez prekida toka snage.

*Ključne reči: planetarni menjač, promena stepena prenosa, dinamički proces, period sinhronizacije.*