[1]NONLINEAR DYNAMICS OF HEAVY GYRO ROTORS

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UDC: 531.383

Summary

The rotors are basic parts in many mechanical systems, such as automobiles, airplanes, helicopters, and so on. The problem of rotor vibrations existed for a long time. Nevertheless, the nonlinear dynamic of motion of rotating parts in engineering such are rotors, coupled rotors, planetary gears or gyro–rotors is actual nowadays. Rotors are analyzed as discs which rotate around axes in various ways. In this paper the rotor is analyzes as a shaft – disc system. The support shaft is vertical while the rotor shaft is horizontal. They may be with section or without section. The disc is eccentric with eccentricity e. A system of nonlinear differential equations is determined. For different cases of eccentricity the motion character analysis is performed by means of phase trajectories. The method of phase plane and phase trajectories in researching nonlinear dynamics properties gives some phenomena such are their stability, transformation of homoclinic orbits, their appearance or disappearance.

For the special case when heavy disc is eccentrically and self rotation axis rotate in horizontal plane around vertical axis with constant angular velocity, a series of graphical presentation with changes of disk eccentricity are presented here.

Key words: rotor, nonlinear dynamics, eccentricity, phase plane, stability

NELINEARNA DINAMIKA TEŠKIH GIRO ROTORA

UDC: 531.383UDC: 621.112

Rezime

Rotori su bazični delovi mnogih mehaničkih sistema, kao što su automobili, avioni, helikopteri, itd. Problem vibracija rotora egzistira odavno. Bez obzira na to, nelinearna dinamika rotirajućih elemenata, poput rotora, spregnutih rotora, planetarnih prenosnika ili giro rotora aktuelna je i danas. Rotori se posmatraju kao diskovi koji mogu rotirati oko osa na različite načine. U ovom radu rotor se posmatra kao deo sistema osovina – disk. Osovina je vertikalna, dok je osa rotora horizontalna. Ove ose se mogu seći, a mogu biti i mimoilazne. Disk je ekscentričan (ekscentriciteta *e*). Dobijen je sistem nelinearnih diferencijalnih jednačina. Za različite slučajeve ekscentriciteta se analizira kretanje preko faznih trajektorija. Metod fazne ravni i faznih trajektorija, pri analiziranju nelinearne dinamike, omogućava analiziranje stabilnosti kao i transformaciju karaktera kretanja.

U specijalnom slučaju, kada ekscentričan disk rotira oko sopstvene horizontalne ose i zajedno sa njom oko vertikalne nepomične ose, dobija se serija faznih portreta za različite vrednosti ekscentirciteta.

[1] *Received: July 2012, Revised: august 2012, Accepted: September 2012*

Ključne reči: rotor, ekscentricitet, fazna ravan, stabilnost, nelinearna dinamika