Научном већу Математичког института САНУ у Београду

Директору Математичког института САНУ

Руководиоцу пројекта ОИ 174001

Извештај са научног скупа

Поштовани,

од 23. до 26. јуна 2019. године одржан је седми српски (32. југословенски) Конгрес теоријске и примењене механике у Сремским Карловцима, Србија. На конгресу сам учествовао са усменим саопштењем рада под називом „Multifactor analysis of dynamics of the slider-crank mechanism“ у оквиру мини-симпозијума "Nonlinear dynamics", организатори проф. др Катица (Стевановић) Хедрих и др Ивана Атанасовска.

За учешће на овој конференцији сам подржан од пројекта *"ОИ174001 Динамика хибридних система сложених структура, Механика материјала"* и руководиоца пројекта *проф. др Катице (Стевановић) Хедрих*, Математичког института САНУ и Министарства просвете, науке и технолошког развоја.

На конференцији је учествовало око 100 истраживача из земље и иностранства, од чега значајан број истраживача са пројекта ОИ 174001. Конгрес је био организован у неколико секција и пет минисимпозијума, од којих су три организовали истраживачи са пројекта 174001. Научне области механике које су биле заступљене на конгресу су: моделирање и методе у нелинеарној динамици, примена фракционог рачуна на проблеме механике, квалитативна и квантитативна анализа нелинеарних динамичких система, наномеханика, биомеханика, стохастички системи, мултидисциплинарни проблеми, нелинеарни динамички феномени, проблеми управљања механичким системима, примена механике на више скала и у реалним инжењерским проблемима из разних области и др.

На конгресу су као пленарни предавачи учествовали проф. др Walter Lacarbonara са Сапијенца Универзитета у Риму (главни уредник часописа Nonlinear Dynamics) и проф. др Здравко Терзе са Универзитет у Загребу, а на предлог проф. др Катице (Стевановић) Хедрих .

Велика част за мене била је добити повељу др Растко Стојановић од стране Српског друштва за механику.

Радни део конгреса је одржан у гимназији у Сремским Карловцима. Конгрес се одржава на две године.

Бранислав Миленковић

27.06.2019.

Бранислав Миленковић
Истраживач приправник, Математички институт САНУ

CERTIFICATE OF PARTICIPATION

This is to certify that

BRANISLAV MILENKOVIĆ

Participated in the

SEVENTH INTERNATIONAL CONGRESS ON THEORETICAL AND APPLIED MECHANICS

Serbian Society of Mechanics

Congress Co-chair

Dr Srboljub Simić

Sremski Karlovci,
June 24, 2019

Congress Co-chair

Dr Mihailo Lazarević

MULTIFACTOR ANALYSIS OF DYNAMICS OF THE SLIDER-CRANK MECHANISM

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Abstract:

Dynamic balancing effect at intensity of reaction forces in joint connecting crank and coupler link was investigated. This problem has not been investigated in available literature so far. Formulations in symbolic form are created for reaction forces in joints and driving torque which affects crank of investigated type of mechanism. Derived formulations enable performance of different type of dynamic analysis for different values of parameters figuring in them. The most general case was investigated when horizontal slider guide was appointed eccentrically in relation to horizontal axis passing through cylindrical joint of the crank. Appropriate diagrams of change of components of reactions forces in mechanisms joints as well as diagrams of intensity change of driving torque which affects crank in function of time, are formed for different values of this type of eccentricity. Quantitative analysis for derived diagrams was performed using formulations of the root mean square values in a certain number of points in appropriate time interval and relevant conclusions and recommendations are given for further investigations in this field.

Key words: slider-crank mechanism, analysis of dynamics, force reactions, balancing mechanism

1. Introduction

A slider-crank mechanism is widely used in technical industry. It is mainly used to convert rotary motion to a translating motion (diesel engine) or vice versa (piston compressor). They have very simple construction, but their members have very high changes of velocity and acceleration, which causes occurrence of high inertial forces. Occurrence of high inertial forces can be solved by balancing mechanism with different methods [1-4]. Mechanism balancing is performed in different phases such as: construction and projection, production, assembly, disassembly and in certain interval during exploitation. For example, during repair of diesel engine while processing the crankshaft, it is important to rebalance it and to check the balancing with adequate devices. If balancing check is not performed, accidents and breakage of the entire engine may occur. Only for that reason, places for insertion of correction mass should be predicted and must not be removed during operation of piston mechanism (see [7]).

2. Analysis of dynamics

Let as consider a slider-crank mechanism shown in figure 1.

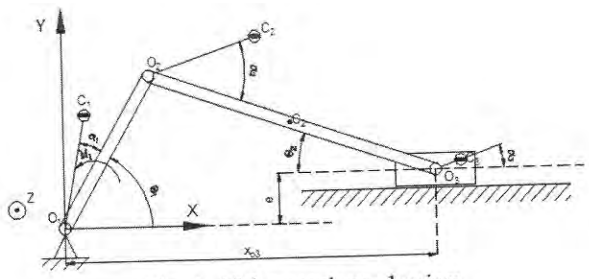

Fig. 1. Slider-crank mechanism

2.1 Determination of dynamic joint reaction forces and driving torque in symbolic form

$$
\begin{aligned}
X_{O_1} &= [-L_1(m_2+m_3)\cos\theta_1 - d_1 m_1 \cos(\alpha_1+\theta_1)]\omega_1^2 - \\
&-[d_2 m_2 \cos(\alpha_2-\theta_2) + L_2 m_3 \cos\theta_2]\omega_2^2 \\
&+[-L_1(m_2+m_3)\sin\theta_1 - d_1 m_1 \sin(\alpha_1+\theta_1)]\varepsilon_1 \\
&+[d_2 m_2 \sin(\alpha_2-\theta_2) - L_2 m_3 \sin\theta_2]\varepsilon_2,
\end{aligned} \tag{2.6}
$$

3. Analysis of influence of eccentricity value of slider position on dynamic characteristics of slidler-crank mechanism

In this part, influence of eccentricity value on reaction forces as well as driving torque of investigated slider-crank mechanism will be presented.

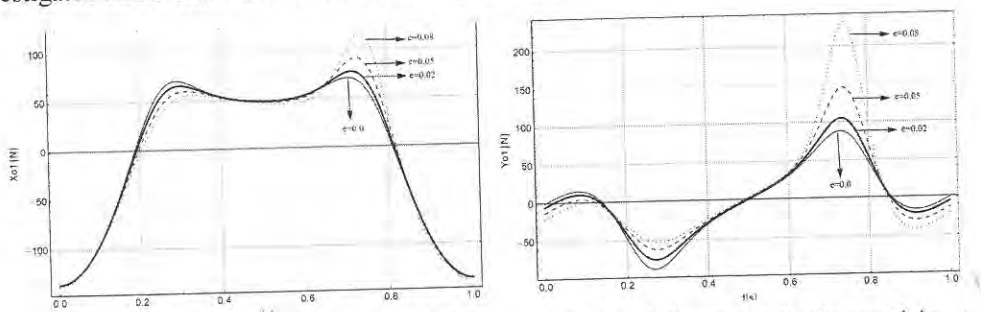

Fig. 2. Diagrams of reaction forces X_{O_1} and Y_{O_1} during time in different values of eccentricity at unbalancing mechanism

3. Conclusions

Quantitative analysis of diagrams presented at figures 2-5 shows that increase in eccentricity value leads to increase of intensity of components all reaction forces as well as driving torque. There is drastic increase of intensity at vertical components of joint reactions. Based on this, when projecting slider-crank mechanism, eccentricity of slider should be equal to zero whenever construction requirements meet that.

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