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Kinematic and dynamic analysis of the manipulator for removal of rough tyres

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Abstract

The paper presents a kinematic and dynamic analysis of the manipulator for removal of rough vehicle tyres. Kinematic and dynamic analysis of the manipulator was performed by means of the Cosmos Motion 2.85 programme. Graphic dependence of kinematic and dynamic magnitudes of some solid bodies is closely connected with the dependence on the velocity of shift of the drive member as well as with dependence on the time. The model of the manipulator was created in Pro-engineer software.

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Keywords: kinematic analysis; dynamic analysis; numerical analysis; Cosmos Motion

1. Introduction

In relation to the kinematic and dynamic analysis and subsequent simulation [1–3] of the planar as well as spatial mechanisms, it is great solution to use Cosmos Motion software program. The considerable advantage of this mentioned program is based on its simplicity from the aspect of modelling and moreover, it is important to point out that utilisation of the mentioned program leads to results which are precise and accurate in the case of the numerical solution of the equations in the whole magnitude referring to motion of mechanism while the given results are obtained in the graphic form.

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2. Kinematic and dynamic analysis of the manipulator for removal of rough tyres

The manipulator for removal of rough tyres (Fig. 1) is composed of twenty five individual bodies which are held together by help of kinematic connections and it is in the accordance with real state. The computational model of the manipulator can be seen in the Fig. 2.

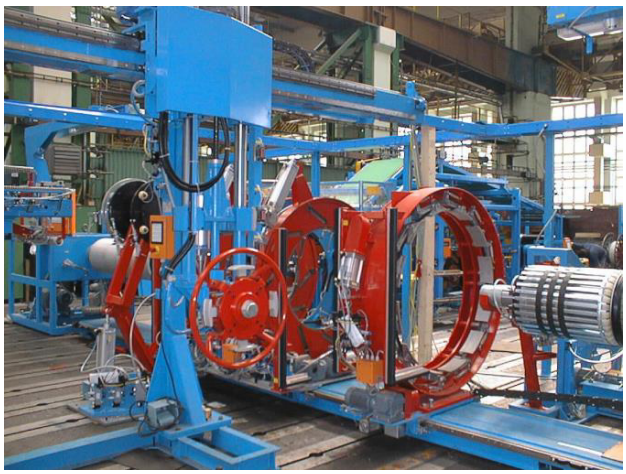

Fig. 1. The manipulator for removal of rough tyres.

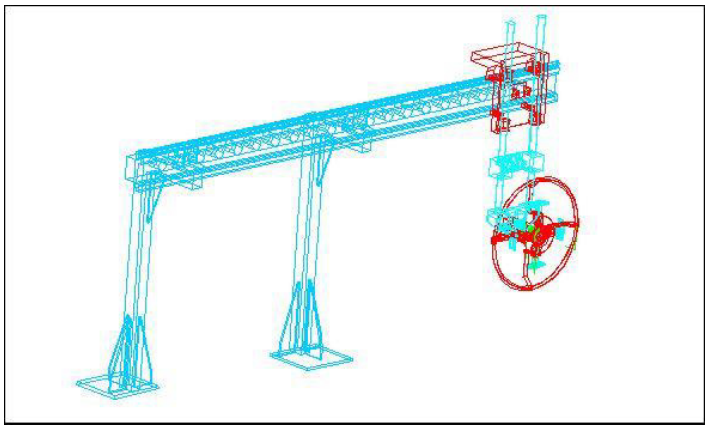

Fig. 2. Computational model of the manipulator.

Using the kinematic analysis [4–6], the main objective is connected with the determination and entering of the position domains, speed (velocity) domains as well as acceleration of the individual items in relation to the specified input values and it can be seen in the Table 1.

Table 1. Influences of external forces and kinematic phenomena on manipulator.

1.	maximum gravity or load capacity, using 22.5 ´´tyre	80 kg
2.	speed (velocity) of movement for manipulating member in horizontal direction	400 $mm.s^{-1}$
3.	speed (velocity) of movement for manipulating member in vertical direction	90 $mm.s^{-1}$
4.	speed (velocity) of disengaging for clamps used for removing	20 $mm.s^{-1}$