VIBROISOLATION SYSTEM OF AN AMBULANCE COUCH WITH THREE DEGREES OF FREEDOM

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In the paper there are deduced differential equations of the vibroisolation system of the ambulance couch. The kinematic excitation is realized in three directions : the vertical translation and the rotations around the both horizontal axes of the car. The suspension of the ambulance couch corresponds to this presumption and is made by the parallelogram; on the upper base there is a double level Cardan suspension.

The linearised system of the motion equations is stated and the preliminary analysis of the dependency of all the three natural frequencies on the selected parameters is made. By vertical kinematics excitation numerical simulation of the excited oscillations is made.

Key words : *air springs, ambulance couch, double Cardan suspension, equilibrium state, external excitation, Lagrange equations,natural frequencies, parallelogram, parametric excitation, vibroisolation system*

1. Introduction

The selected conception of the ambulance couch suspension with three degrees of freedom corresponds to a simplified presumption of the kinematic excitation of the ambulance car undercarriage: we confine to the vertical translation and the rolling and pitching (around the both horizontal axes). The location mechanism is formed with a parallelogram with the axes parallel with the transversal axis of the car and double Cardan suspension located on the upper basis of the parallelogram. The locating mechanism is provided with vibroisolation elements (pneumatic springs and hydraulic dampers).

The deviation of the respective dynamic system and its analysis is to enable the selection of the vibroisolation elements and proposal of their placement in the locating mechanism so that the vibroisolation at the selected kinematic excitation and arbitrary load might be optimal.

2. Preparatory kinematic consideration

In order to describe the general position of the human body on the couch, we start from coordinate system $O_{0\,\xi_0\eta_0\zeta_0}$, firmly connected with the ground (meridian, east-west line, vertical). Our fundamental system $O_{0\,\xi\eta\zeta}$ is rotated through constant course angle χ around axis $\zeta \equiv \zeta_0$.

According to the presumption, stated in the introduction, we come to the general position of the loading area first with vertical shift $\vec{r}_\zeta^{\,\mathrm{T}} = [0, 0, \zeta(t)]$ (system $O_{\xi_1\eta_1\zeta_1}$ see Fig. 1), second with two angular displacements $\alpha(t)$, $\beta(t)$. System $O_{\xi_2\eta_2\zeta_2}$ is rotated by $\alpha(t)$ in

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