ANALYTICAL AND EXPERIMENTAL ANALYSIS OF VISCOELASTIC IMPACT IN APPLICATION TO THE BUMPER OPTIMIZATION

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The analytical model of axial impact of loosen solid body with «Kelvin-Voigt» bumper was developed.

The bumper was modeled as a parallel combination of linear spring and viscous damper. The approaching velocity of a loosen body was constant. The «bumper + body» cooperative motion was considered up to the moment when the body acceleration changed its sign.

The simple differential equation of cooperative motion was obtained. By solving this equation the following characteristics of impact were obtained: duration of impact, moment of peak acceleration appearance, values of body peak acceleration and bumper deformation.

At model validation experiment the time history of acceleration at collision of the steel rod with the rounded edge and the plastic pad was registered. By using the measured time of impact duration, the value and moment of appearance of peak acceleration the bumper stiffness, loss factor and approaching velocity were identified. The analytically obtained impact acceleration curve was practically identical to this in experiment.

For the bumper optimization the product of peak values of acceleration and deformation was used as a criterion. The universal optimal bumper loss factor was found out.

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