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MATHEMATICAL MODELING OF THE FRONTAL IMPACT

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A simple model of vehicle frontal structure is used for research of vehicle behavior in frontal impact at stationary and undeformable barrier.

Vehicle is modelled by a dynamic system, consisted of three concetrated masses and seven elastic elements, which present deformable parts of car body and other parts in engine compartment. By solving the system of differential equations of motion, dynamic responses of the structure were obtained (displacements, velocities and accelerations of cocnentrated masses). These results enable comparison of different designs of the engine compartment.

In this paper, influence of bumper stiffness, sheet metal stiffness and longitudinal position of the engine is analyzed. With numerical results, well-known conclusions of the vehicle safety are confirmed.

Key words: impact simulation, frontal impact, mathematical model, vehicle safety.

MATEMATIČKO MODELIRANJE ČEONOG UDARA U BARIJERU

Jednostavan model čeone strukture vozila je korišćen za ispitivanje ponašanja vozila pri čeonom udaru u nepokretnu i nedeformabilnu barijeru.

Vozilo je predstavljeno dinamičkim sistemom koji se sastoji od tri koncentrisane mase i sedam elastičnih elemenata, kojima su predstavljeni deformabilni delovi čeone strukture vozila.

Rešavanjem sistema diferencijalnih jednačina kretanja dobijeni su dinamički odzivi (pomeranja, brzine i ubrzanja masa sistema) na osnovu kojih je moguće vršiti uporedne analize različitih konstruktivnih rešenja motorskog prostora sa aspekta bezbednosti.

U radu je analiziran uticaj čvrstoće branika, čvrstoće čeonog kostura i podužni položaj motora na ubrzanja koja se prenose u putnički prostor. Numeričkim rezultatima, koji su prikazani dijagramski, su potvrđeni zaključci iz literature, što potvrđuje valjanost modela.

Ključne reči: simuliranje udara, čeoni udar, matematički model, bezbednost vozila.