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Effect of Rainflow Cycle Number on Fatigue Lifetime of an Arm of a Vehicle Suspension System

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***Abstract*—Fatigue is considered as one of the main cause of mechanical properties degradation of mechanical parts. Reliabilities methods are appropriate for fatigue analysis using uncertainties that exist in fatigue material or process parameters. Current work aims the study of the effect of the Rainflow cycle number on fatigue lifetime of an upper arm of the vehicle suspension system. The major part of the fatigue damage induced in suspension arm is caused by two main classes of parameters. First parameter characterizes materials properties and a second one describes equivalent force generated by road excitation and passenger's number. Therefore, representative sampling of Young's modulus and equivalent loading are selected as input parameters to conduct repetitive finite elements simulations by Monte Carlo (MC) algorithm. Strain-life approach based on Manson-coffin and Ramberg-Osgood equations is used in order to determine fatigue lifetime of each combination of input parameters. Thereafter, response surface is built according to preselected performance function. A PYTHON script was developed to automatize finite element simulations of the upper arm according to a design of experiments. Preliminary results show Rainflow primary cycles to have significant effect on obtained cycle's number to fracture. Load generated by excitation road have a remarkable quasi-linear inversely proportional effect on fatigue lifetime.**

***IndexTerms*—Monte Carlo, Response surface, Rainflow cycle, Performance function, Fatigue, Suspension system.**