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Particle Swarm Optimization for Modified Spencer Model Under Different Excitations

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Abstract : The distinct materials have exposed the technological advancement that has been used to facilitate the presentation of buildings to effectively suppress vibration. Recently, researchers have increased their advantages, including decreased power requirements, mechanical simplicity, and a high power capability, because of the regulated Fluids and their applications. The fluids used in magneto-rheological dampers also improved their mechanical characteristics. The damper force caused by the current excitement adjustment was applied within the damper to the electromagnet. A supreme model is needed to be able to accurately estimate damping force according to the superior present hysteresis damper behavior to use the advantage of this remarkable method. Due to the supreme coverage of the nonlinear field of the hysteresis loop among the parametric model, the Spencer model has been commonly used for MR damper to describe hysteresis behavior. Despite this, there are still essential differences in the simulation and experimental outcomes. A model according to the Spencer model is being used here to simulate the damper's nonlinear hysteretic behavior by taking the excitations of frequency, current, and amplitude as displacement and velocity as input variables. This suggested model has a greater benefit than the historically uncertain parameters of the Spencer model, where it can be re-evaluated if a new grouping of excitation parameters is preferred. Experimental experiments in the damping force measuring machine were carried out for validation of the simulations using MATLAB software. This paper aims to explain the optimal value of the parameters for the proposed model using a biological-inspired algorithm called Particle Swarm Optimization. The working principles of the classical Particle Swarm Optimisation (PSO) algorithm for a better understanding of the basic framework of a PSO algorithm will be discussed, and also learn to demonstrate the functionality of a PSO algorithm in MATLAB. A PSO algorithm's design is similar to that of bird flocking and starts with a randomly generated population group. They have fitness values to determine the population. They update the population, check for optimal parameters with random strategies, and update the simulation resets as well. However, not all algorithms guarantee success. In displacement, velocity, and time curves, a great deal was found between the prediction and experimental works with an appropriate error as a result of the confirmation that the model can correctly measure the hysteresis damping force and the error has decreased relative to the Spencer model.

Keywords : modeling and simulation, semi-active control, MR damper RD-8040-1, particle swarm optimization, magnetorheological fluid, based spencer model
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