FORECAST APPROXIMATE RELATIONS R_S-μ-T_S-T_B FOR SEISMICALLY ISOLATED STRUCTURES VIA USING ARTIFICIAL BEE COLONY ALGORITHM AND REGRESSION MODEL

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Base isolation is one of the most common passive control systems for seismic resistant of the structures. Seismic isolation systems prevent reaching the energy of earthquake to the superstructure by adding horizontal flexibility to the base. Therefore an earthquake resistant structure weaker than the fixed base structure is required, while it can be expected that the damage to the structure caused by the earthquake is significantly reduced. Currently, the design codes prohibit extensive yielding of the isolated superstructure, but it does not mean that yielding never occurs in the superstructures.

Forecasting has always been a crucial challenge for organizations as they play an important role in making many critical decisions. Previous studies have investigated relationships between R-μ-T for fixed base structures. Vidic et al., in 1994 used bilinear approximations for R-μ-T relations. Nassar and Krawinkler, 1991; Miranda, 1993; Miranda and Bertero, 1994 have suggested the use of nonlinear curves for R-μ-T relations for fixed base structures. Tsiavos et al., (2013) have used bilinear curves for R-μ-T relations for structures Relies on friction pendulum bearings.

So in this paper, the effect of nonlinear behaviour of superstructure is considered to identifying relations between the strength reduction factor Rs, the ductility μ, the vibration period of the super structure Ts, and vibration period of the base isolation Tb, for base isolated structures. A nonlinear two degrees of freedom system is modelled by using open system for earthquake engineering simulation software (OpenSees). The time history analysis of the superstructure is done by considering the elastic with linear hardening behaviour, while the elastic behaviour is assumed for the isolation system. To estimate the relations parameters, based on non-linear regression model which presented by Behnamian and FatemiGhomi (2010), we used artificial bee colony (ABC) algorithm which refers to a multi-point search approach, is employed as a meta-heuristic technique.

For example based on the nonlinear time history analysis, the Mean influence of the Tb on the Rs with hardening ratio αs=0.0, super structure and base isolation damping ratio ξs=ξb=0.02 and μ=2 is shown in Figure 1.

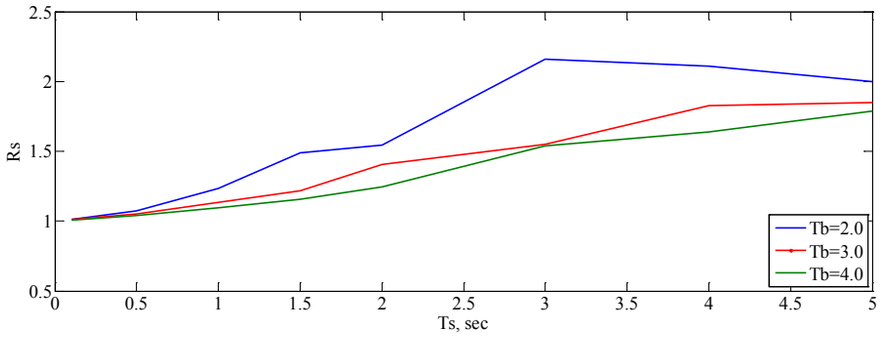

Figure 1. Strength reduction factor Rs, vs. super structure vibration period Ts, for different values of the base isolation vibration period Tb=2, 3, 4 sec and μ=2 (actual values)

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