Public Abstract
First Name:Zuheng
Middle Name:
Last Name:Kang
Adviser's First Name:Roger
Adviser's Last Name:Fales
Co-Adviser's First Name:
Co-Adviser's Last Name:
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Title:Parameterized Uncertainty Model Using a Genetic Algorithm With Application To An Electro-Hydraulic Valve Control System

Uncertainties in the mechanical system severely increase the complexity of the system. Present the uncertainties can be parameterized by listing the coefficient from the transfer function. The attempt to reduce the uncertainties by capturing the type of data, then reproducing the data with a simple form easy for doing further analysis is the kernel technique in building uncertainty model to transform uncertainties into an easier form. However, since the traditional optimization algorithms proposed by previous researchers may trapped in solving non-convex polynomial function optimization problem, yet genetic algorithm is better to avoid non-convex problem, any discoveries on developing the effective GA (genetic algorithm) with better convergence haves been presented. Because GA contains unpredictable variations, a fine tuning on the algorithm specifically for one type of problem is needed. Focusing on increasing the speed and performance of the algorithm, a series of normalization method is adopted based on the assumption of linear transformation; as well as preventing converging to a false solution (such as the twisted result), series of coefficients are defined. The GA optimization is working by selecting by roulette wheel method with probability weights for the population.
The parameterized uncertainty model presented here are demonstrated from test data for an electro-hydraulic pilot valve control system problem, including the parameterizing an uncertainty class determined from test data for 30 replications of an electro-hydraulic flow control valve. The process of reproducing the data set is then achieved by re-sampling technique with a manipulated probability distribution function. Thereafter this parameterization of the uncertainty used for analyzing the robust stability of a control system for a class of valves is possible.