

Piezoelectric Actuator Design via Multiobjective Optimization Methods

Abstract of PhD Thesis, M. Eng. Bo Fu aus Sichuan, VR China

Piezoelectric actuators find widespread applications in almost all fields of engineering. Ultrasonic welding, traveling wave motors or ultrasonic scalers are examples of systems operated in resonance. Diesel injection valves, optical scanners and atomic force microscope are examples of systems operating in a quasistatic mode.

The performance of piezoelectric actuators is mainly determined from the tuning of the actuator characteristics to the load characteristics. Except for some very limited special cases, no simple general design guidelines can be given today. Mathematical methods for the optimization of piezoelectric actuators are therefore a very important tool for the system designer.

In most practical applications of piezoelectric actuators, there exist multiple design objectives which often are contradictory to each other by their very nature. This dissertation has studied various multiobjective optimization methods and applied them in the design of piezoelectric transducers. The main contribution has been to formulate the design of a piezoelectric transducer as a constrained multiobjective optimization problem involving continuous and discrete design variables and to find Pareto-optimal solutions using multiobjective evolutionary algorithms. The determination of the preferred designs using high level information was also addressed.