

Abstract of the PhD Thesis
„Entwurf schwach gedämpfter piezoelektrischer Ultraschallsysteme“

Continuously new applications for piezoelectric actuators are developed. These applications need an applicable power supply which can adapt amplitude, frequency and phase of the actuator voltage to the ultrasonic processes. The power supply should work on one hand as efficient as possible. On the other hand it should allow the highest miniaturisation potential and a cost sensitive realisation. The complex coupling of the mechanical and electrical subsystems complicates the design of an optimal adjusted complete system.

In this thesis the focus lies in particular on the class of weak damped ultrasonic systems. Their strongly changing terminal behaviour when operated near resonance defines high demands of the feeding power electronics. The terminal behaviour will be represented by an actuator model which is based on continuum-mechanical relations and considers geometry and material parameter. Selected power converter concepts for these systems are considered in detail. Mainly resonance and PWM converters are investigated. To evaluate the suitability of the particular converter concept to feed weak damped ultrasonic systems the miniaturisation potential of the needed filter components and the obtainable grade of efficiency is considered. The model for actuator and power converter are united and are a fundamental basis to configure piezoelectric ultrasonic systems in an integrated design.