

## CHAPTER 5

### CONCLUSIONS

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This research has investigated the traveling wave characteristics of a curvilinear motor/stator system when excited with various patterns of piezoelectric actuators and evaluated the feasibility if this is a viable design option to ultrasonic motors. Operation principle of the curvilinear arc stator was reviewed. Governing equations of the arc stator partially bonded with piezoelectric actuator patches were derived. Dynamic responses of the arc stator system with two configurations (i.e., actuators placed at mid-span or near boundaries - Patterns 1 and 2) were investigated and compared. Both analytical and finite element results demonstrate similar dynamic characteristics of the traveling wave behavior and also effective locations of actuator patches. One of the two case studies suggests that the configuration of partially bonded piezoelectric actuators near the stator supports (i.e., Pattern 2) can generate effective traveling waves. Thus, this configuration is an alternative actuator design to the fully laminated piezoelectric actuators. This study provides important design information of using partially laminated actuators instead of fully laminated piezoelectric actuators on the ultrasonic curvilinear arc motors. The stator/motor system, although with less actuator patches, can still generate effective traveling waves driving the motor. Consequently, the new partially bounded stator/motor system would be lighter and needs less components and less power at reduced cost, easier maintenance and improved reliability.