ABSTRACT

As MEMS technology continue to grow, MEMS device design optimization is becoming an interesting and important research issue. In this thesis, the design optimization of MEMS accelerometer is discussed. The primary intention of this research is to identify the optimal parameters to design an efficient accelerometer in MEMS. The main objective of this investigation is to find a optimum design of MEMS accelerometer, which satisfies a set of given constraints. In order to design a MEMS device to meet the given specifications, the relationship between the device performance and various design parameters must be investigated. MEMS accelerometers can be used in air-bag deployment systems in automobiles.

Designing of MEMS accelerometer may include the parameters like Beam length, Beam width, Beam depth, Beam mass, proof mass etc. The accelerometer employs a double folded beam flexure system and the mass being displaced is the proof mass. Due to the complex nature of the problem, a genetic algorithm (GA) is developed for the optimization of parameters of a MEMS accelerometer. The GA attempts to minimize the Die Area (DA) and so the four optimal parameter values can be determined. The experimental results will show the optimal design of MEMS.

In order to reduce the Die Area (DA) further, the optimization will be done by using Artificial Bee Colony Optimization (ABC) algorithm. This algorithm
will overcome the issues of GA and the ABC based design parameter optimization technique will be helpful to design MEMS accelerometer architecture. The fitness is based on the parameter Die Area (DA) with specified range. The implementation of the ABC algorithm method is done by MATLAB 7.12 and the performance analyzed with some GA methodology.

Finally the research work involves in the optimization of design parameters like Die Area (DA) and a novel parameter, called Force. Artificial Bee Colony Optimization (ABC) and Particle Swarm Optimization (PSO) are the two algorithms used to optimize these parameters. ABC performs the primary optimization and PSO does the optimization of the fitness solution resulting from the execution of ABC algorithm. Employing the two optimization algorithms in a combined way yields improved optimized parameters, which are then engaged in the efficient design of MEMS accelerometer.