Modal Optimization of Dynamic Structures

Master Project Proposal

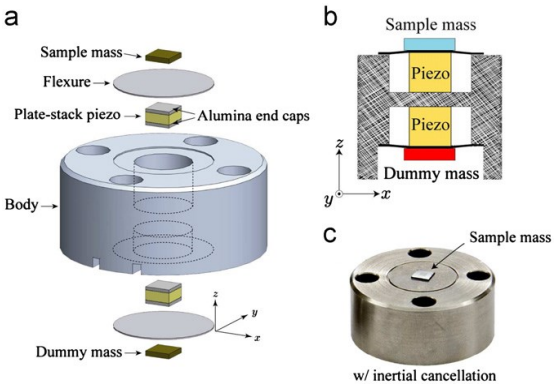

Fig.1 Counter mass balanced structure for high speed nano-positioning unit.

The dynamic behaviour of structures is an important topic in many fields and in all scales ranging from Micro-nano technology up to civil engineering. Either when the structure is deliberately excited to perform a task in dynamic mode, or when it is subjected to unwanted dynamic loads, the modal characteristics and specifically the ratio between resonance frequencies of the different modes play a crucial role in dynamic behavior and motion pattern of the structure.

The primary objective of this master assignment is to develop new topology optimization techniques to enhance the dynamic characteristics of the structures.
As an application one can isolate some part of the structure from unwanted vibrations by introducing desired structural nodes, for example in nano-positioning units(Figure 1).

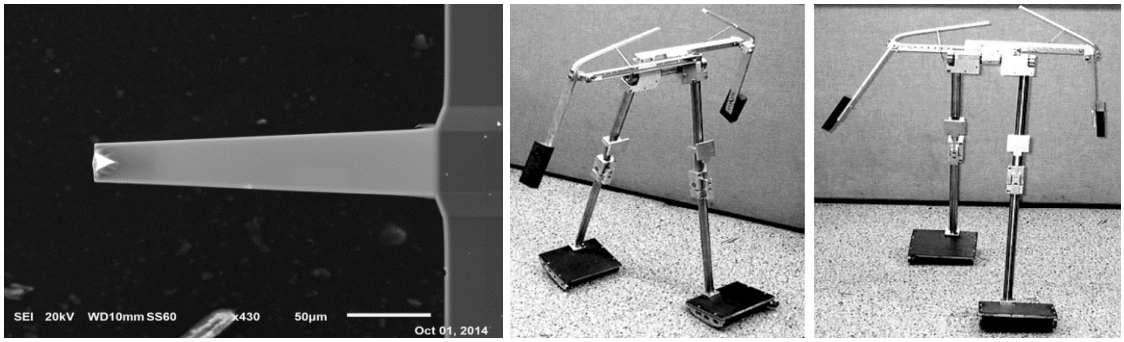

Fig.2 a) Dynamically tuned cantilever for atomic force microscopy. b) Collins walking and runing passive biped robot.

Another application can be passive generation of a desired motion pattern which can be used in passive robots or sensing structures such as AFM cantilevers(Figure 2).

Assignment:
In this project the student will develop and implement topology optimization methods to optimize the mode shapes and frequencies of dynamic structures, and study their performance in practical test cases.

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