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## NOISE SUPPRESSION DESIGN FOR NOTEBOOK COMPUTER (NB)

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# Noise Suppression Design for Notebook Computer (NB)

## Abstract

An active dynamic anti-vibration/noise suppressing control subsystem to enable lighter and thinner notebook computer to produce higher performance with low noise level.

Microcontroller intelligent algorithm autonomously control close loop monitoring vibration sensors and exciting of vibration devices, e.g. Piezoelectric or Linear Resonant Actuator to continuously mitigate vibration/noise level. The lower system vibration/noise floor allows enabling faster fan speed and higher efficiency power profile to produce higher overall performance and improve user experience with system noise under increased system loading operations.

## Publication

- Disclosed is a design and method for using an active counter vibration to reduce system noise generated from various system vibration sources, e.g. fan noise, ceramic cap noise.
- Today most designs use passive solution like adding absorptive materials to reduce vibration/noise which is ineffective, inconsistent and unreliable and the size of current active noise canceling fan is too big to fit in notebook space and cost is very expensive.
- It is well-known that, vibration is noise source. For example, fan noise is caused by heatsink fin vibration with airflow. Our proposal is to use very small size active vibration sources that counter affect system vibration source, so that combined vibration is much reduced and that results in much less system noise.
- Linear Resonant Actuators (LRA) is tiny and easy to place. It can generate vibration at a large range of frequency, so ideal to use as counter vibration source. For example, if placing it on the heatsink and adjust its vibration basing on heatsink's airflow vibration, combined heatsink vibration can be reduced and Fan noise can be much reduced.
- Advantage is that Enable the NB design has higher performance and user has a very good lower noise experience, Smaller size, Effective and flexible
- Fig. 1 and Fig. 2 show the implementation of two application cases noise reduction coming from Fan and Capacitors, Fig .3 showing control block diagram. Fig.4 shows the example of the noise suppressing control elements.

## Fan Noise Suppression

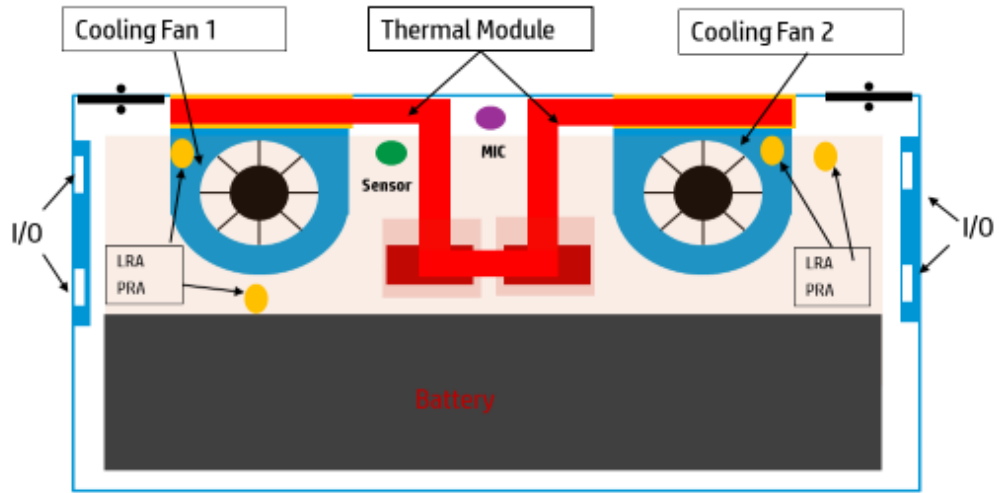


Fig.1 Example of cooling fan Noise Suppression of optimization of placement of LRA/PRA

LRA – Linear Resonant Actuator  
PRA – Piezo Resonant Actuator

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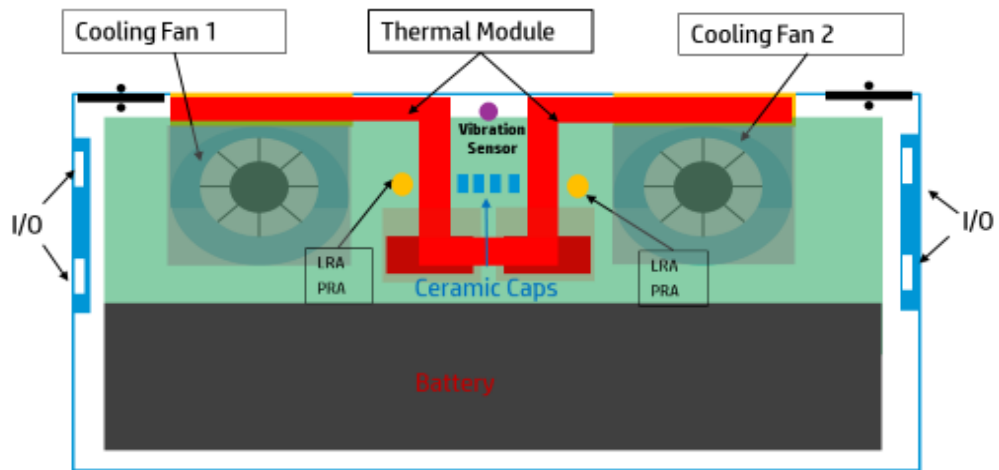


Fig.2 Example of Ceramic Capacitor Noise Suppression

LRA – Linear Resonant Actuator  
PRA – Piezo Resonant Actuator

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## Vibration/Noise Suppressing Control Block Diagram

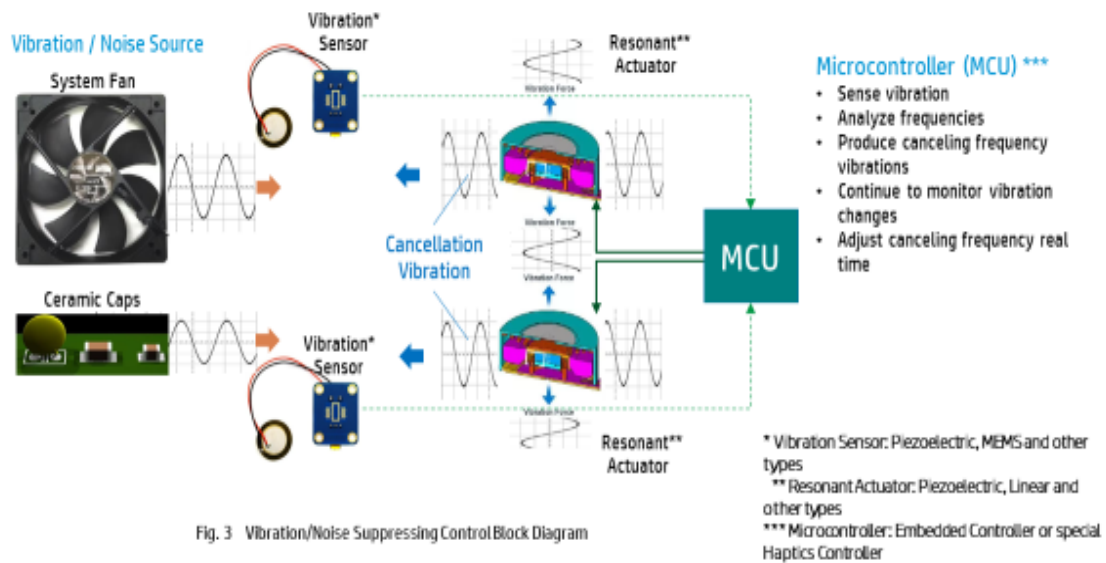


Fig. 3 Vibration/Noise Suppressing Control Block Diagram

## Resonant actuator



Fig. 4 Vibration/Noise Suppressing Control elements

*Disclosed by Richard Lin, Baosheng Zhang, Fangyong Di and Sean Ma, HP Inc.*