Double Mounting vs. Controlled Air Mounting

'Double mounting', also known as "two-stage mounting" is a vibration isolation scheme considered and used for Diesel generators and other machinery in marine and land applications, e.g., Diesel generators onboard superyachts. Figure 1 shows a schematic of such mounting system.

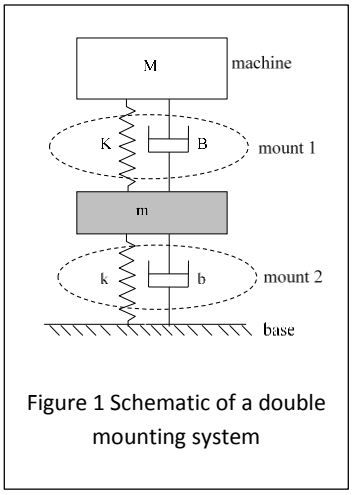

Figure 1 Schematic of a double mounting system

Although very effective in lowering the transmission of vibration at high frequencies, double mounting as with any other passive isolation technique, has its own drawbacks including the design complexity, weight penalty, large space requirement, and ***excessive cost*** associated with the added auxiliary mass (also known as seismic mass) which depending on the design could weigh up to 100% (or more) of the weight of the isolated machine. Note that a double mounted isolated system has twice as many resonant frequencies (at least 12) as those of a single mounted system; this is assuming the auxiliary mass is designed and fabricated properly so that it is rigid enough and does not introduce its own flexible-body resonant frequencies into the mix. Keeping all these resonant frequencies from matching any of the harmonics of engine vibration is a major challenge contributing to the design complexity of two stage mounting systems.

An alternative isolation strategy, without all of the above-listed drawbacks, that exceeds or matches the effectiveness of the double mounting over the frequency range of interest, is DEICON's "Computer Controlled Air Isolation System". Under the supervision of a computer, semi-active and active control strategies are used to keep the desirable attributes of air mounting, i.e., unsurpassed isolation especially at low frequencies as well as on-demand damping, and address the undesirable attributes, i.e., low lateral stiffness, etc.

Figure 2 depicts the transmissibilites (a) and motion (b) of a single degree of freedom isolation system, using 3 different arrangements of 1) single elastomeric mounting (black/dotted line), 2) double elastomeric mounting (blue/dashed line) with m_auxiliary/M_machine=0.25, and 3) air mounting under the control of a computer (red/solid line). Comparison of single and double elastomeric mounting (black/dotted line and blue/dashed line) clearly shows the advantage of double mounting at higher frequencies. On the other hand, the vibration isolation effectiveness, judged by the transmissibility traces of Figure 1(a), of air mounting system is almost as good as double mounting at high frequencies and it is by far superior to double mounting at low frequencies.

Using computer control, on-demand damping can be added to the air mounts in real-time when needed, e.g., to tame the vibration of the machine during the start-ups and shut downs; note that this computer-controlled damping scheme adds damping to the air mounts to better their shock isolation attributors without deteriorating their vibration isolation effectiveness.

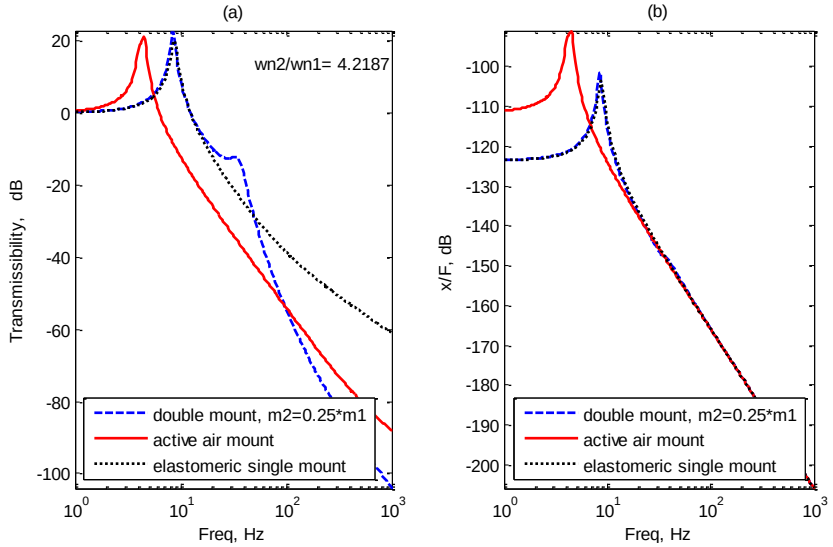

Figure 2 Comparison of transmissibilities (a) and motion of the machine (b) using single mounting (black/dotted line), double mounting (blue/dashed line) and active air mounting

The higher motion of the machine at low frequencies can also be addressed by the active and semi-active stiffness control.

All in all, compared to double mounting, air mounting with computer control provides excellent vibration isolation with no weight penalty.