

BARRY CONTROLS



DEFENSE & INDUSTRY
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Question: What is focused mounting?

Answer: Focused mounting is a way to decouple the vibration modes of a six degree of freedom system without moving the isolators to be in line with the CG. Decoupling was discussed in our FAQ related to Base Mounting vs. CG Mounting where the latter was an option for decoupling, and isolators were moved to fall in the same plane as the CG.

In a focused mounting system, decoupling is achieved by inclining the isolators towards the CG while leaving them in a mounting plane away from the CG. This is also known as an “equivalent CG system”.

When a six degree of freedom system is decoupled, its six modes of vibration are forced to be independent of each other; i.e., not coupled. In a coupled system, motion or vibration excitation in one direction (degree of freedom) causes response in multiple directions. In a decoupled system, excitation in one direction results in response only in that direction. From a practical standpoint this means that decoupled systems generally provide improved vibration isolation performance compared to coupled systems.

In order to focus isolators properly, they need to have a certain stiffness ratio along their axis and perpendicular to that axis. The higher the ratio, the farther the elastic center can be projected. Otherwise, they are just inclined, and the system is not truly decoupled.

Figure 1 graphically shows the relationship among the isolator axial-to-radial stiffness ratio, radial or lateral spread of the isolators, and distance from the CG to the isolator mounting plane. A common misconception is that decoupling is achieved by inclining the axes of a group of isolators such that they intersect at the CG of the supported mass, but as can be seen in Figure 1, this is not the case.

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Determining the focus angle

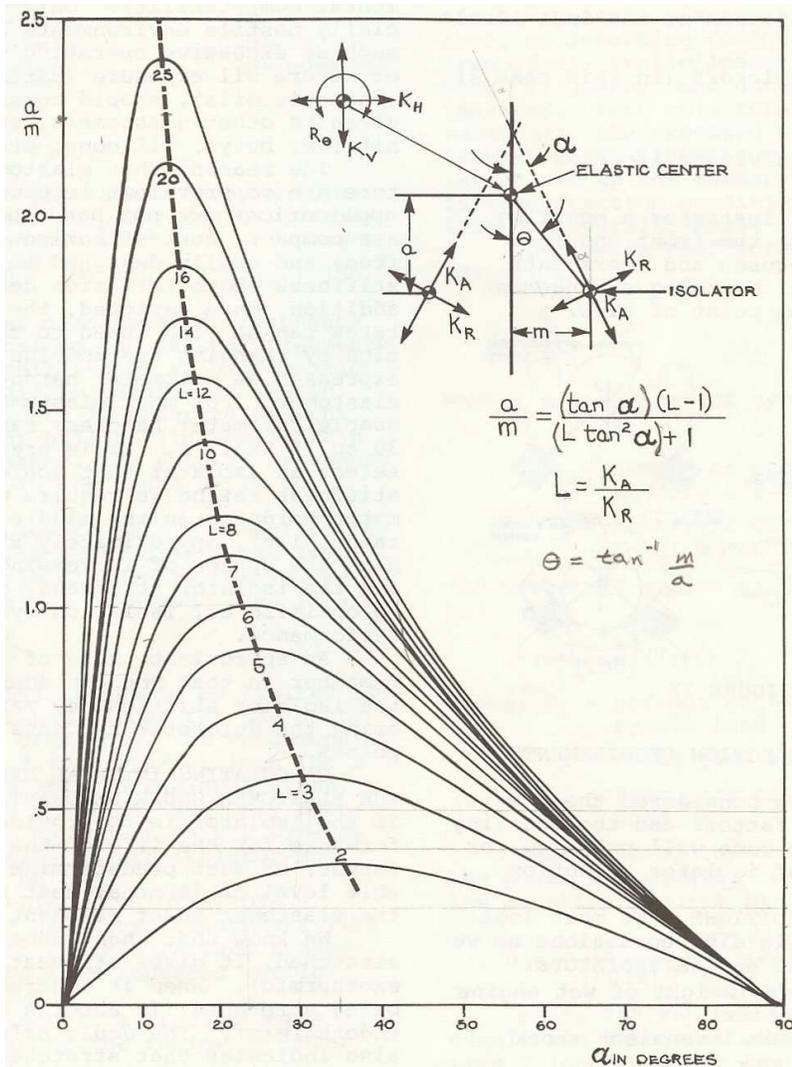


Figure 1

Where:

- L -- Isolator Axial-to-Radial Stiffness ratio
- m -- Lateral spread of isolators
- a -- CG offset from isolator mounting plane
- α -- Angle of isolator axis from the equipment centerline

You can see that focusing cannot be achieved if the axial-to-radial stiffness ratio is not high enough to compensate for a large 'a' (distance from isolator mounting plane to CG) to 'm' (isolator spread) ratio.

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For example, if the a/m ratio were 1.0 in an isolation system, the axial-to-radial stiffness ration would have to be at least 6 to achieve focusing for decoupling, and the isolators would be inclined at about 22°. A lower ratio would prevent decoupling regardless of the tilt angle. See figure 2 below.

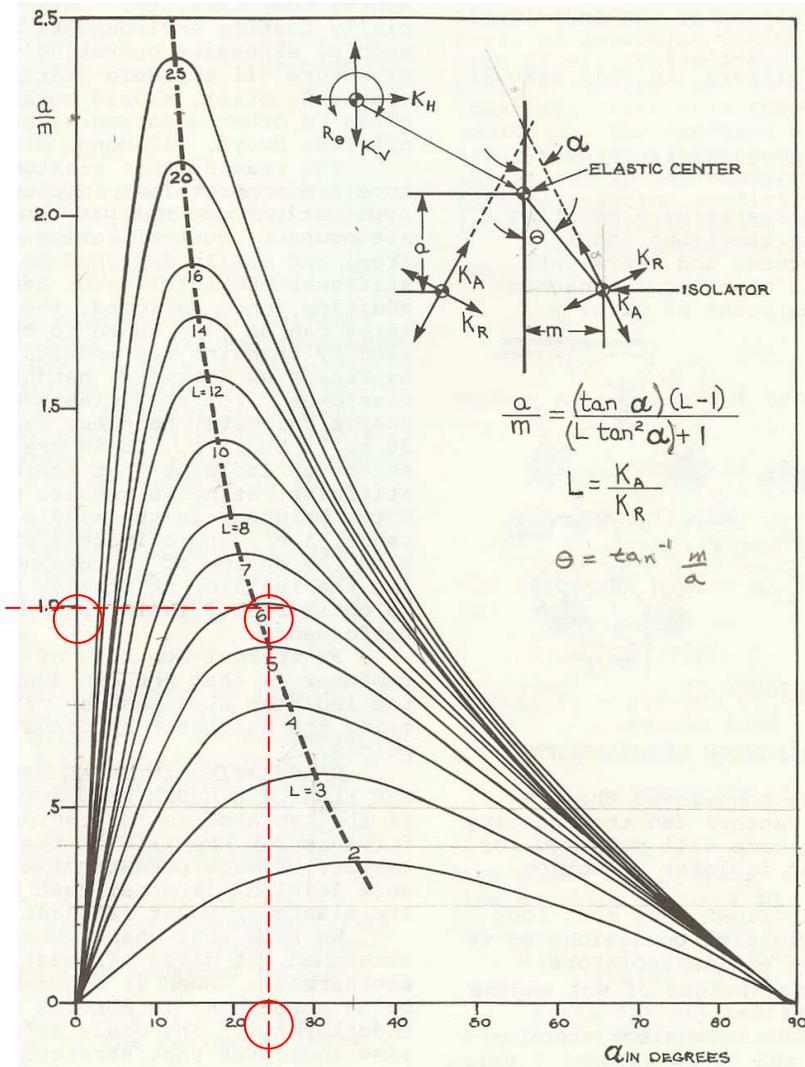


Figure 2

So, why would focusing be used instead of CG mounting when an isolation system needs to be decoupled? Focusing would be the only option if decoupling were needed and the mounts could not be relocated. However, special brackets must be accommodated to provide the inclination, and installation tolerances are more critical when inclination is involved. Finally, special isolators would probably be needed to exhibit the stiffness ratio required to properly decouple the six degree of freedom modes.