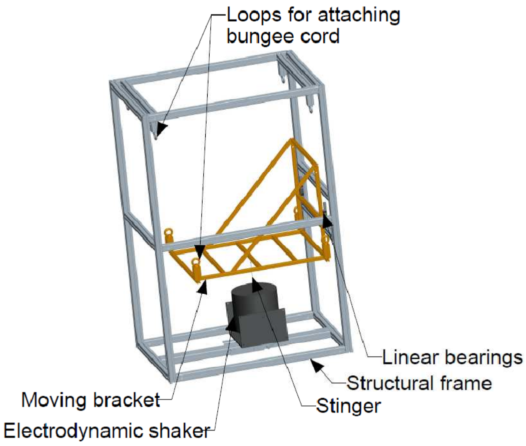

Figure 12 Testing apparatus incorporating electrodynamic shaker

In the testing rig, an elastic bungee cord supports the weight of the moving bracket which holds the test specimen, such that the shaker must only apply the force necessary to produce the desired acceleration. Linear bearings constrain the moving bracket to a single translational degree of freedom so as to protect the shaker from damaging moments. However, the entire test rig may be turned on its side in order to cause excitation in the horizontal direction.

The position of the shaker underneath the moving bracket is adjustable such that the stinger may be positioned to act directly through the centre of gravity of the device to be tested. This is important for the MagLev prototype to ensure that the purely vertical mode can be excited in testing in order to reproduce the conditions of the modelling as faithfully as possible. In testing of the fully active (non-contact) prototype, it is planned to excite the device in both the vertical and horizontal directions.

In order to measure the system's vertical transfer function across the specified frequency range, two accelerometers will be used. One will be placed on the base structure and one on the platform as close as possible to the axis of rotation to avoid cross-coupling with the rotational degree of freedom (and thereby distortion of the results). The experimental results will be compared with those obtained through the modelling, and system and model parameters corrected accordingly.

Structural resonances from the aluminium framing of both the MagLev prototype and testing rig are expected to be at high enough frequencies so as to couple minimally with the planned low-frequency testing.

CONCLUSIONS

Theoretical modelling has shown that the realisation of load-independent resonance frequency is feasible for a vibration isolator using inclined cuboid permanent magnet springs. The MagLev prototype is under construction, with the passively stable configuration to be tested shortly. While the resonance frequency of the prototype is too high to be used effectively for low frequency applications such as laser interferometry, it is expected that active vibration control in the vertical direction will allow the resonance frequency in this direction to be driven much lower, and therefore make the system much more appropriate for such an application (as would scaling up the volume of the magnetic springs).

Once the passively stable prototype has been successfully demonstrated and tested to validate the modelling, it is planned to implement active non-contact stabilisation (true levitation) through the use of electromagnetic actuators.

Some nonlinearity exists in the plant due to the inherent nonlinear force-displacement relationship of the magnetic springs, but it is expected that for small displacements the plant can be assumed to behave linearly at frequencies far from resonance, and adaptive control techniques may also be implemented to overcome the nonlinearity issues if operation over larger displacement ranges is required.

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