supported by the support frame via spring means to form a mass-spring system having a certain resonance frequency. A force actuator is configured to apply a variable driving force between the inertial mass and the support frame. A vibration sensor is configured to measure vibrations in the structure to be damped. A controller is configured to control the force actuator to adapt the driving force as a function of the measured vibrations. The controller comprises a filter determining a magnitude and/or phase of the driving force as a function of frequency for suppressing the measured vibrations in the structure. The filter (H) can be configured to provide increased magnitude (M) of the driving force (Fd) over a range (R) of predetermined damping frequencies that are above the resonance frequency (fn) of the mass-spring system (2,3) and can further be configured to provide an anti-resonance dip in the magnitude (M) of the driving force (Fd) at the resonance frequency (fn) of the mass-spring system (2,3) to suppress resonant behavior of the mass-spring system (2,3) itself.

By configuring the filter to provide an anti-resonance dip in the magnitude of the driving force at the resonance frequency of the mass-spring system undesired resonant behaviour of the mass-spring system at the resonance frequency can be suppressed. This may prevent e.g. unwanted amplification at the resonance frequency of the mass-spring system which may not be specifically geared to any frequency of vibrational disturbances. For example, the anti-resonance dip may be modelled based on a mass of the inertial mass and a spring constant of the spring means to provide an inverse resonance of the mass-spring system at the resonance frequency. For example, the driving force may be adapted to keep the force exerted by the inertial mass constant, at least in a frequency range around the resonance frequency of the mass-spring system.

By configuring the filter to provide one or more resonance peaks in the magnitude of the driving force at one or more predetermined damping frequencies, vibrations at these frequencies can be more effectively damped with less or no dependence on the specific resonant frequency of the mass-spring system. By providing the controller damping frequencies above the resonance frequency of the mass spring system, the damper can operate more efficiently than if the damping resonances are below the resonance frequency of the mass spring system. Accordingly, the system may be more adaptable to different situations. Furthermore, the filter may provide

CLAIMS

1. An active inertial damper system (100) for damping vibrations (V1,V2) in a structure (11), the system (100) comprising:

- a support frame (1) configured for attachment to the structure (11) to be damped;

- an inertial mass (2) supported by the support frame (1) via spring means (3) to form a mass-spring system (2,3) having a resonance frequency (fn);

- a force actuator (4) configured to apply a variable driving force (Fd) between the inertial mass (2) and the support frame (1);

- a vibration sensor (5) configured to measure vibrations (V1,V2) in the structure (11) to be damped; and

- a controller (6) configured to control the force actuator (4) to adapt the driving force (Fd) as a function of the measured vibrations (V1,V2), wherein the controller (6) comprises a filter (H) determining a magnitude (M) of the driving force (Fd) as a function of frequency (f) for suppressing the measured vibrations (V1,V2) in the structure (11), wherein the filter (H) is configured to provide increased magnitude (M) of the driving force (Fd) over a range (R) of predetermined damping frequencies that are above the resonance frequency (fn) of the mass-spring system (2,3) and further configured to provide an anti-resonance dip in the magnitude (M) of the driving force (Fd) at the resonance frequency (fn) of the mass-spring system (2,3) to suppress resonant behavior of the mass-spring system (2,3) itself.

2. The system according to claim 1,wherein the filter (H) is configured to provide one or more resonance peaks in the magnitude (M) of the driving force (Fd) at one or more predetermined damping frequencies (f1,f2) that are above the resonance frequency (fn) of the mass-spring system (2,3).

3. The system according to any of the preceding claims, wherein the anti-resonance dip is modeled based on a mass of the inertial mass (2) and a spring constant of the spring means (3) to provide an inverse resonance of the mass-spring system (2,3) at the resonance frequency (fn).

4. The system according to any of the preceding claims, wherein the filter (H) is configured to provide at least two separate resonance peaks in the magnitude (M) of the driving force (Fd) at respective predetermined damping frequencies (f1,f2) that are both above the resonance frequency (fn) of the mass-spring system (2,3).

5. The system according to any of the preceding claims, wherein the resonance frequency (fn) of the mass-spring system (2,3) is lower than twenty-five Hertz.

6. The system according to claim 2, wherein the damping frequencies (f1,f2) of the filter are at least twenty-five percent higher than the resonance frequency (fn) of the mass-spring system (2,3).

7. The system according to claim 2, wherein the predetermined damping frequencies (f1,f2) are separated by at least ten Hertz.

8. The system according to any of the preceding claims, wherein the inertial mass (2) is supported by the support frame (1) via one or more primary springs (3a,3b) and one or more support springs (3c,3d) that are preloaded at a position of the inertial mass (2) where the one or more primary springs (3a,3b) are not loaded,

wherein the support springs (3c,3d) are preloaded to at least partially counteract a gravity force on the inertial mass (2) to alleviate a tension on the one or more leaf springs (3a,3b).

9. The system according to any of the preceding claims, wherein the system (100) comprises multiple damper devices (10a,10b), each damper device comprising a respective support frame (1), inertial mass (2), spring means (3), and force actuator (4), wherein the multiple damper devices (10a,10b) are controlled by a central controller (6).

10. The system according to any of the preceding claims, wherein the support frame (1) is connected to a building floor (11).

11. The system according to any of the preceding claims, wherein the support frame (1) of the active inertial damper system (100) is connected to a machine support frame (12) for supporting a vibration sensitive machine (13), wherein the vibration sensitive machine (13) is standing on the machine support frame (12) supported by machine feet (13a,13b); wherein vibration sensors (5a,5b) of the active inertial damper system (100) are positioned at positions of the machine feet (13a,13b) for damping vibrations at the machine feet (13a,13b).

12. The system according to claim 11, wherein one or more damper devices (10a,10b) are attached at a bottom of the machine support frame (12) support frame (1) below the vibration sensitive machine (13).

13. The system according to claim 11, wherein the machine support frame is standing on a building floor, wherein the machine support

frame (12) has a higher stiffness than the building floor.

14. A method of damping vibrations (V1,V2) in a structure (11), the method comprising:

- providing a damping device (10) comprising a support frame (1) attached to the structure (11) to be damped, an inertial mass (2) supported by the support frame (1) via spring means (3) to form a mass-spring system (2,3) having a resonance frequency (fn); and a force actuator (4) configured to apply a variable driving force (Fd) between the inertial mass (2) and the support frame (1);

- measuring vibrations (V1,V2) in the structure (11) to be damped; and

- controlling the damping device (10) to adapt the driving force (Fd) as a function of the measured vibrations (V1,V2) using a filter (H) determining a magnitude (M) of the driving force (Fd) as a function of frequency (f) for suppressing the measured vibrations (V1,V2) in the structure (11), wherein the filter (H) provides increased magnitude (M) of the driving force (Fd) over a range (R) of predetermined damping frequencies that are above the resonance frequency (fn) of the mass-spring system (2,3) and further provides an anti-resonance dip in the magnitude (M) of the driving force (Fd) at the resonance frequency (fn) of the mass-spring system (2,3) to suppress resonant behavior of the mass-spring system (2,3) itself.