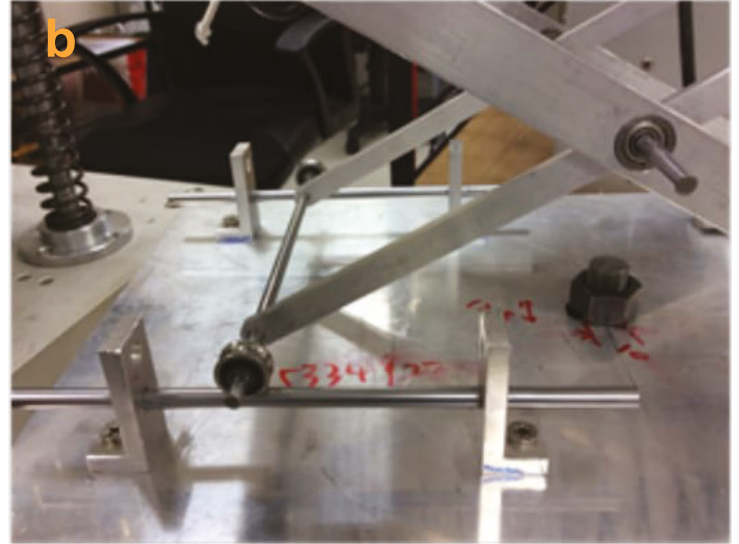
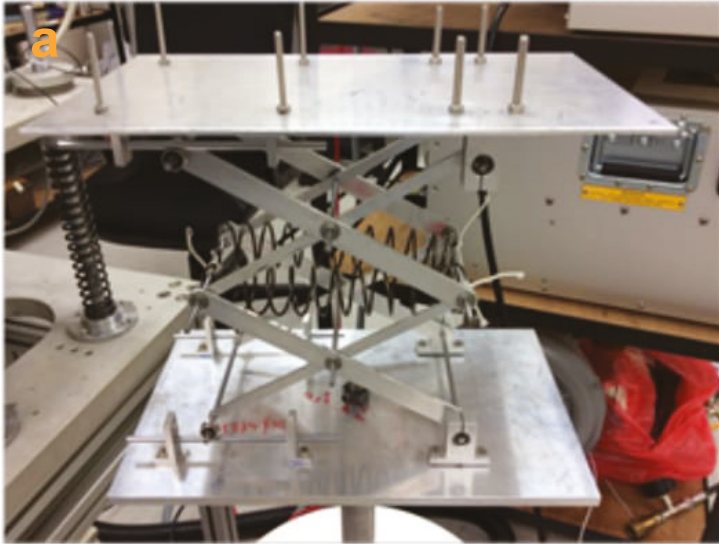


High Performance X-shaped Passive Control

Anti-vibration Structure 仿生物 X 型結構革新抗振技術

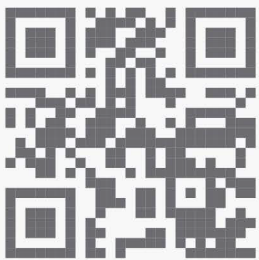


Dr Xingjian JING, Department of Mechanical Engineering



The X-shaped bio-inspired structures are novel designs of passive vibration isolation systems by using only linear spring and damping components to achieve superior nonlinear vibration isolation. The technology provides excellent passive quasi-zero stiffness of high loading capacity, and nonlinear high damping at resonant frequencies but low at others, without unstable nonlinear equilibrium. The structure can provide flexible and adjustable stiffness up to zero and adjustable nonlinear damping characteristic. The stiffness is decreasing with the increase of compression or extension of the structure, different from existing spring systems which have higher stiffness subject to more compression or extension. The technology is easy to implement and flexible in usage of low cost. The systems can be with n-layers of X-shaped structures to suit different applications, such as leg/joint design of robots, limb-like structured suspension for mobile robots with track, protection of high-precision machinery, space launch and on-orbit applications.

在微重力的環境下，例如身處太空船上，長期的微振動會有機會損壞艙內的儀器。微振動是指由機械系統所產生的低幅度振動。理大研究團隊研發了一個能大幅減低由機械系統所產生的振動的仿生物非線性抗振系統，相對現有技術，其性能更可靠，成本更具效益。團隊參照雀鳥昆蟲肢體結構的抗振功能，尤其是每天啄木數百次卻不受震盪影響的啄木鳥，研發出一個兼具被動和主動控制系統的優點的X型抗振結構。此技術對任何振動均產生接近「零反應」，在近零的低動剛度下仍保持高負載能力。這技術能廣泛應用於各種工程運作與抗振防振設施，包括精密機械儀器、機械人、鐵路、離岸平台等。另外，團隊亦發明了系統化的綜合方法，通過振動訊號的時間序列數據，識別重要的非線性特徵。有關訊息透過虛擬光線法，能夠定位和辨析衛星的潛在問題，例如懸掛結構出現螺栓鬆脫和裂縫的情況。



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