Team invents bio-inspired anti-vibration structures with wide engineering applications

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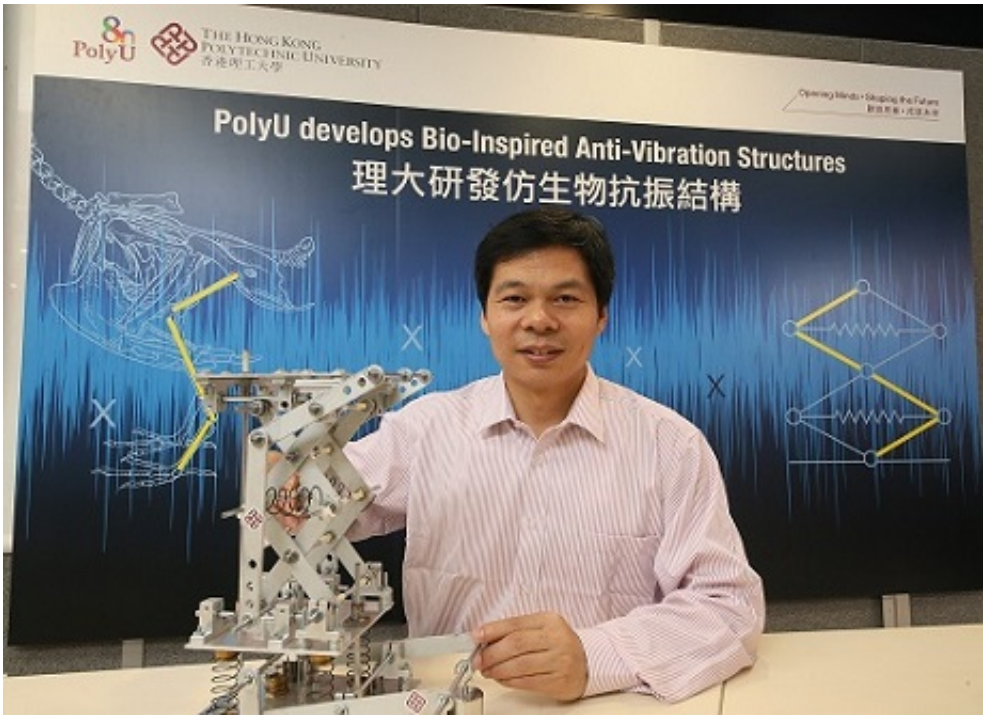

PolyU's novel bio-inspired anti-vibration structures has won the 2017 TechConnect Global Innovation Award. PolyU is the first tertiary institution in Hong Kong receiving this award, with 3 innovation projects snatching the honor. Credit: The Hong Kong Polytechnic University

The Department of Mechanical Engineering of The Hong Kong Polytechnic University (PolyU) has developed a novel bio-inspired nonlinear anti-vibration system that can significantly reduce vibration in mechanical systems. The system is better than existing devices in cost-

efficiency and performance reliability, and has many applications.

Inspired by the motion vibration control of the limb structures of birds and insects, the novel X-shaped system demonstrates nearly zero response to any vibration (quasi-zero low dynamic stiffness), but simultaneously exhibits high loading capacity. It also features automatic high damping for strong vibrations, and low damping for small vibrations, thus preventing high damping's adverse effect on a system's normal functioning during small vibration. These advantages stem from the novel system's nonlinearity—a unique feature lacking in most vibration control systems today, which are usually following linear system design. The novel system can therefore be applied very widely in engineering practices and vibration control devices.

Superb Anti-vibration Device enhances Safety Protection for Workers

As a first step in transferring the innovation into daily life benefit, the research team led by Dr Xingjian Jing, associate professor of the department, has obtained funding, facilities and trial support from the construction sector to develop an assistive anti-vibration exoskeleton for hand-held jackhammers.

With superb anti-vibration performance, the new device can prevent hand-arm occupation diseases among construction workers. Using the new device, the vibration of hands and arms in drilling concrete ground can be significantly suppressed to the ideal safety level, compared with many commonly-used jackhammers on the market. The very low cost for manufacturing and maintenance, and its great design flexibility for adapting to devices of different sizes and materials, can also enhance its potential applications. At present, the market price of a common passive control jackhammer is around HK$1,000. It is estimated that PolyU's

assistive anti-vibration exoskeleton added to such passive control system will need only an additional HK$1,000 to $2,000, offering performance far exceeding high-quality active control devices that cost about HK$,10,000 to 40,000.

Provided by Hong Kong Polytechnic University