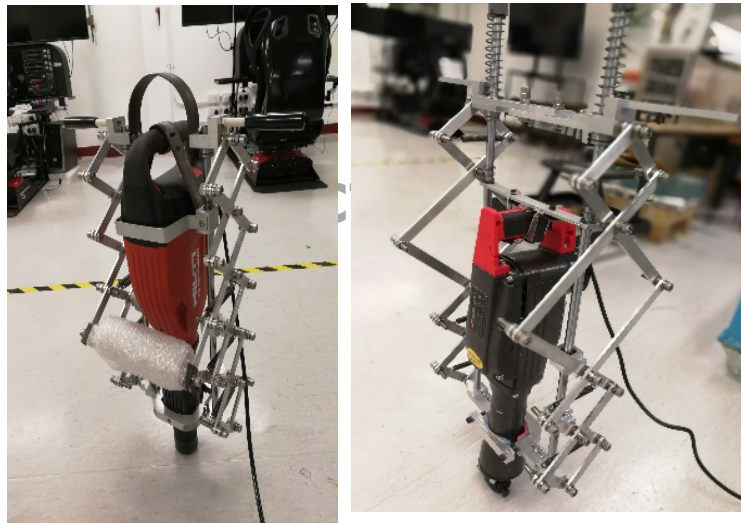


# Product Presentation

Applicant Name: Xingjian Jing

Product Name: Bio-Inspired Anti-Vibration Exoskeleton (BIAVE)

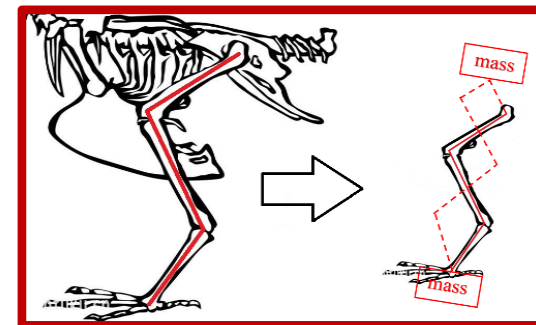
Specification: A bio-inspired anti-vibration exoskeleton aims to prevent construction practitioner suffering from Hand-Arm Vibration Syndrome. The exoskeleton helps to minimize the vibration level acted on the construction practitioner while the practitioner operates on hand-held vibrating tool.



- Core Functions:
  - Vibration isolation of the handles
- Technology Used:
  - Bio-inspired nonlinear anti-vibration tech
- Construction Process involved:
  - Construction demolition or refurbishment
- Key Improvement in Construction Process:
  - Productivity
  - Safety

Job Reference:

During 2016-2018, the prototypes have been extensively trailed in several construction sites of HK.



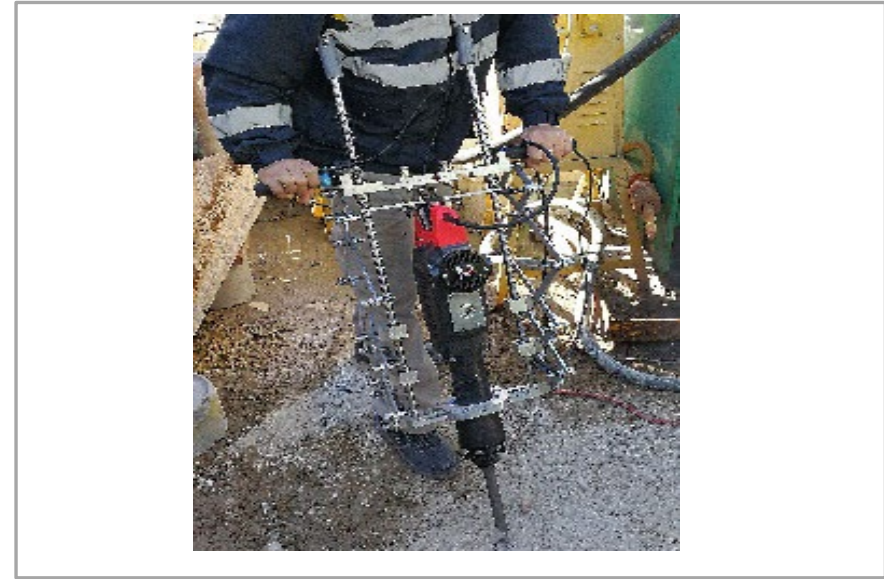
Bio-inspired technology

# Innovative Features

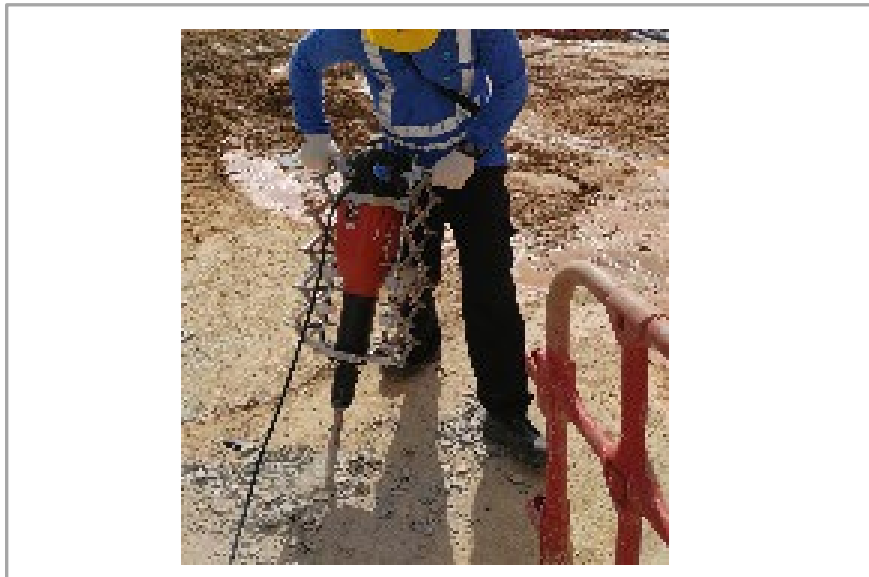
- Core Technology:
  - Bio-inspired nonlinear anti-vibration technology (also referred to as X-shaped anti-vibration)
- Patent (if applicable):
  - US invention patent: PASSIVE VIBRATION REDUCING APPARATUS, (US 10,675,743)
- Comparison with current practice and popular models:
  - Technology: The BIAVE is a passive, nonlinear stiffness and damping system
  - Specification: It is lightweight and compact, and adaptable to different size of jackhammers
  - Benefits: Compared to demolition breakers with active control systems, the BIAVE can save 75% above in cost, and a remarkable reduction of hand-arm vibration by 90% can be obtained.
- Comparison with similar Pre-approved list products and competitors:
  - There are no competitors of its kind in the market
- First Launch Date:
  - The first version was created in early 2016 and the latest one is in 2018
- Awards (if applicable):
  - International: 2017 US TechConnect Innovation Award
  - Local: The 1st Prize Award Winner for Construction Safety in the Hong Kong CIC (Construction Industry Council) Construction Innovation Award 2017

# Adoption Example

- The prototypes were extensively trailed in several construction sites during 2016-2018
- Excellent anti-vibration performance was observed



[Trials by construction workers]



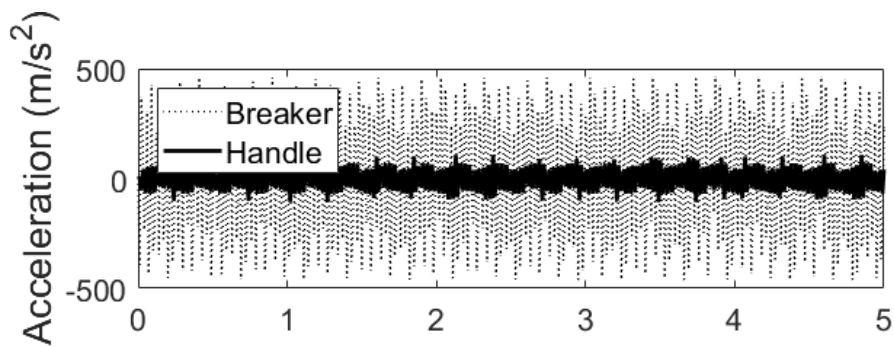
[Trials by Town gas]



[Trials by construction workers]

# Benefits – Safety

- Improve Safety by:
  - Without BLAVE, the vibration level is Bigger than 14 or 15  
The safe trigger time is <15 mins
  - With BLAVE, the vibration level is smaller than 5  
The safe trigger time is > 2 hours



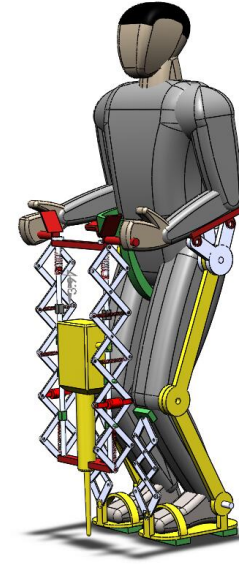
The vibration is much smaller at handles

Tool Type	Upper quartile vibration magnitude ( $m/s^2$ )	Trigger time to reach Action Value
Clearing saws	5	2 h
Die grinders	6	1 h 20 min
Chainsaws	7	1 h
Angle grinders	7	1 h
Needle scalars	7	1 h
Impact wrenches	9	40 min
Sanders (random orbital)	9	40 min
Vibratory rammers	12	20 min
Chipping hammers	15	< 15 min
Hammer drills/combi hammers	16	< 15 min
Saws	16	< 15 min
Road breakers	17	10 min
Demolition hammers	18	< 10 min
Rock drills	20	< 10 min
Rammers	38	< 3 min

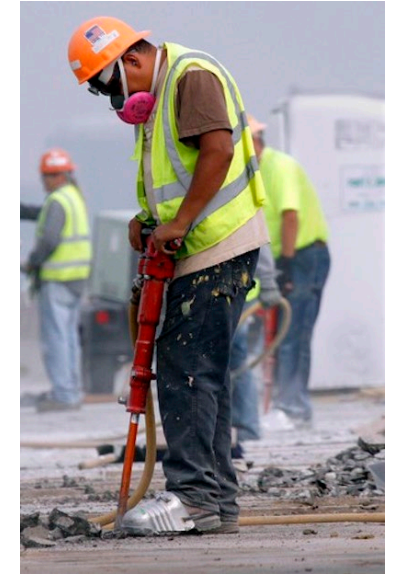
The safe trigger time is different with different vibration level

# Benefits – Productivity

- Improve productivity:
  - With BIAVE, the vibration level can be reduced to 5 or below
  - The continuous working time can be prolonged to 7 hours or more
- Traditional Output:
  - Traditionally, with the vibration level around 15, the continuous working time is about 30 min



VS



How vibration level and duration affect exposure

