

## **Principle and control strategy of mechanical noise**

Sheng Liu, Rudong Du

Shandong University of Science and Technology, Qingdao, 266590 China.

---

*Abstract: Under the background of rapid economic development, the machinery industry is also developing rapidly. While bringing convenience to people, it also brings some mechanical noise problems to a certain extent. These noises will harm people's physical and mental health and normal life to a great extent, which requires us to attach great importance to the mechanical noise, study and analyze the noise by scientific methods, and limit the noise pollution to the allowable range. In this paper, the principle of mechanical noise and the identification method of noise sources are analyzed, and several strategies for noise control are proposed.*

*Keywords: Mechanical noise; Noise source; Silencing device; Control strategy.*

---

### **1. INTRODUCTION**

With the development of China's economy, the scale of the machinery industry is expanding and the quantity is increasing. These machines bring many conveniences to people, but some problems of mechanical noise are brought to a certain extent. Noise is the sound that people do not need. The vibration of the machinery and its structural motion, such as impact, collision, wear and imbalance with inertia, produces vibration, and the noise is transmitted in the air<sup>[1]</sup>. As a kind of signal, noise can be used to diagnose the running faults of machines and measure the integrity of mechanical structures and manufacturing quality. As a pollution factor, noise has a great impact on the living environment of human beings. The existence of mechanical noise is not only harmful to the life of the engineering machinery, but also to the physical and mental health and normal life of the people to a great extent. Controlling noise is to obtain a good acoustic environment and limit noise pollution to an acceptable range. This requires us to attach great importance to mechanical noise and try to minimize it. In this paper, the principle of mechanical noise and control strategy will be analyzed and discussed.

### **2. PRINCIPLE OF MECHANICAL NOISE PRODUCTION**

Because of the different ways of running machinery, the principle of noise generation is also different.

(1) Vibration generation<sup>[2]</sup>

A. Rotating machinery: A lot of mechanical equipment itself or some part of the parts are rotating, often caused by the loss of assembly or the defects of the bearing to produce abnormal vibration, and then produce noise.

B. Impact: When an object is impacted, a large number of kinetic energy will turn into vibrational or noise energy in a short time, and the range of frequency distribution is very wide, such as punch, press bed, forging equipment and so on, which will produce such noise.

C. Resonance: Each system has its natural frequency. If the frequency range of the excitation is overlapped with the natural frequency, it will produce large amplitude vibration noise, such as engine, motor and so on.

D. Friction: This kind of noise causes noise due to slippage between the contact surface and the attachment surface. The common equipment is cutting and grinding.

#### (2) Flow field generation

The phenomena of aerodynamic noise, turbulence, jet flow, cavitation, gas cutting and eddy current generated by flow. When air flows through a tube or a metal surface at a high speed, the general air flows in a catheter to prevent noise from causing turbulence or a large and rapid pressure change.

#### (3) Combustion generation

During the combustion process, explosion, exhaust and combustion may affect the disturbance of ambient air. All these phenomena will be accompanied by noise. For example, engines, boilers, smelting furnaces, turbines and other types of combustion equipment produce such noise.

#### (4) Other noise

In daily life, such as indoor appliances, such as air-conditioner, sound, smoke pump, TV, air conditioning equipment, are all noise sources.

### **3. IDENTIFICATION OF NOISE SOURCES**

To solve the noise problem, noise sources should be identified first, including the type of sound source and its spatial distribution. In general, there are many noise sources of mechanical noise. Through measurement and analysis, they are arranged according to the contribution of the total sound pressure level, and then the main noise sources can be taken measures to achieve good results<sup>[3]</sup>. The main methods of noise source identification are as follows:

(1) The subjective evaluation method. The human ear itself is a very sensitive acoustic instrument. The experienced technicians can listen to the ear by the ear. It can distinguish the frequency characteristics, the intensity and the directivity of the noise sources of the mechanical equipment, which can be used as a reference for further measurement and analysis.

(2) The distribution and operation method. The influence of radiation noise on the measurement points of various equipment on the industrial production line is different. Even the same equipment, the noise of different parts of the equipment is different. Where possible, all kinds of mechanical equipment will be operated separately, or the mechanical parts that need to be identified are separated from each other and measured and compared separately.

(3) The lead coating method. Also known as the local exposure method, that is, the use of lead and glass cotton and other high noise insulation materials will be covered by mechanical, and then each exposed a component to measure.

(4) Near field measurement. The microphone is very close to the source surface, and the sound pressure level is measured near each noise source. The method is suitable for the analysis of medium and high frequency noise of large scale mechanical equipment.

(5) The method of surface velocity measurement. The sound power of each component can be obtained by estimating or measuring the mean square vibration velocity of each component surface.

#### **4. CONTROL STRATEGY OF MECHANICAL NOISE[4]**

(1) Selection of reasonable materials for engineering machinery and equipment

To a large extent, the material of construction machinery and equipment determines the size of noise, which requires us to rationally select materials for construction machinery and equipment. This requires us to pay attention to the internal damping property of the material under the premise of determining the performance of the material, and the internal damping performance is the size of the internal damping capacity of the material after the absorption of certain energy or after the vibration, that is, the noise produced by the better internal damping material is less noise. The noise generated by materials with poor internal damping is relatively large. At the present stage, the polymer material on the market is much better than the internal damping properties of the main metal materials such as iron, aluminum and copper. In the same state, the polymer materials can use the internal friction to produce the loss reaction, thus converting some vibration energy into heat energy dissipation, thus realizing the engineering machinery. Control of noise. Therefore, under the premise of meeting the requirements, we can appropriately adopt some polymer materials to control the noise of construction machinery.

(2) Installation of sound insulation device

The installation of sound insulation device is an important strategy to control the noise of engineering machinery. The principle of noise reduction is to reduce the internal consumption of noise by using all kinds of materials with poor sound transmission performance, and thus prevent the effective transmission of noise. For example, many silk weaving factories have installed sound absorbent cotton inside the machine room, which reduces the noise of the machine room and reduces the noise spread out of the machine room. In addition, we can also install multilayer heat-resistant materials to reduce the internal friction of the noise passing through these materials, thereby reducing the noise propagation to the outside world.

(3) Installation of sound elimination device

The installation of silencer is also an important means to control the noise of construction machinery. It is the most effective noise reduction technology at present. The noise elimination device is mainly used for noise reduction in intake pipes and exhaust pipes. It helps air circulation and effectively organizes noise diffusion. The silencer fan is a new type of noise reduction device, which makes use of the friction between the blades and the rotation of the

fan leaves, so that the impeller which is affected by the gas can produce a certain damping, and then the purpose of controlling the noise is achieved. This tells us that we should install noise elimination devices in order to achieve the goal of noise reduction according to specific control needs.

#### (4) Noise reduction from the individual

In addition to noise control from the aspect of construction machinery, we can also do noise reduction from personal protection. For example, the workers in a production workshop can wear better earplugs or earmuff to prevent too much noise from entering the ear, and the residents can effectively control the noise produced by the construction machinery by closing doors and windows, installing sound insulation curtains or muffling devices. In a word, with the development of our country's economy, we should pay attention to the noise produced by the lock of the engineering machinery while paying attention to the development of various projects. This requires us to have a deep grasp of the principle of the noise of the engineering machinery, and explore in practice the most scientific spirit, the most rigorous attitude and the most professional level, to study the effective measures to control the noise of the engineering machinery, to promote the development of various projects in our country and to ensure the normal life of the people.

## 5. CONCLUSION

As a pollution factor, noise has a great impact on the living environment of human beings. The existence of mechanical noise is not only harmful to the life of the engineering machinery, but also to the physical and mental health and normal life of the people to a great extent. Controlling noise is to obtain a good acoustic environment and limit noise pollution to an acceptable range. In this paper, the principle of mechanical noise generation and identification methods of noise sources are analyzed and discussed, and several strategies for noise control are put forward. The aim is to improve human self-protection.

## REFERENCES

- [1] Fumao Wang, Yongsheng Ren, Baokun Han. Foundation of mechanical vibration and noise analysis [M]. Beijing: National Defense Industry Press, 2006:166-167.
- [2] Longgang Zhou, Jinpeng Zhao, Xianglong Meng. Analysis on the noise principle and control strategy of construction machinery [J]. engineering machinery abstracts, 2012 (06): 35-38.
- [3] Qingzhao Ceng. Analysis of the noise principle and control points of construction machinery [J]. China high and new technology enterprise, 2015 (16): 94-95.
- [4] Ji Duan. Principle and control strategy of construction machinery [J]. Construction machinery, 2018 (10): 15-18.