

“Using the AI diagnostic solution jointly developed by INESA Intelligent Technology (IIT) and the Fujitsu R&D Center (FRDC), we have reached a key breakthrough in our quality inspection process.”

Chen Chao  
Head of Inspection  
Nanjing High Accurate Drive Equipment  
Manufacturing Group Co., Ltd. (NGC)



## Applying AI for efficient, accurate quality inspection of entire range of gearbox products

### At a glance

**Country:** China  
**Industry:** General Equipment  
Manufacturing  
**Founded:** 1969  
**Number of workers:** 6,000  
**Website:** <https://www.ngctransmission.com/en/home.html>

### Challenge

Nanjing High Accurate Drive Equipment Manufacturing Group (NGC) previously carried out quality inspections on products using manual sampling. This meant there were problems of inefficiency, incorrect inspection results and items missing inspection. It was also not possible to trace any defects back to their original causes.

### Solution

INESA Intelligent Technology (IIT) cooperated with Fujitsu R&D Center (FRDC) to create a set of intelligent diagnostic solutions based on the Physical-AI Hybrid Model. Efficient quality inspection covering the entire range of products has been achieved, helping NGC transform and upgrade its quality inspection model without creating additional workloads.

### Benefit

- Replace traditional inspections based on manual sampling, achieving efficient and intelligent full-product inspection
- Inspection efficiency has achieved a 30-fold increase. The detection rate of defects and faults has reached more than 99%
- Locate the faulty frequency band and trace back the cause of any flaws to their source in the production process
- By constructing a knowledge graph, the skill and experience inheritance of quality inspectors has been promoted to a high level

## Nanjing High Accurate Drive Equipment Manufacturing Group Co., Ltd. (NGC)

NGC, headquartered in Nanjing, China, was established in 1969. It is currently the first-ranked domestic and third-ranked global manufacturer of wind power transmission equipment. It is also an industry-leading manufacturer of gear equipment. With advanced technology, reliable quality and full service, NGC has become a model enterprise for technical innovations in China. The NGC brand has gradually become famous throughout China and has gained international recognition, as one of the most competitive companies in its industry.

### Products and Services

- Intelligent diagnosis solution based on Physical-AI Hybrid Model
- Knowledge graph for product flaws and faults

### Exploring the transformation of quality inspection models

As a leading manufacturer of gearboxes and power transmission equipment, NGC provides first-class products and services to key wind turbine manufacturers across the world. The company allows millions of households globally to reliably access clean energy. In order to prevent defective products from entering the market, NGC needs to perform quality inspection on gearboxes before they leave the factory, all without affecting production.

Chen Chao, Head of the NGC Inspection Department, says, "We produce hundreds of gearbox products every day. Each quality inspector judges whether there are any faults by manual testing. Even very experienced quality inspectors need up to an hour to complete the required tests. However, in order to keep up with the pace of production, we need to complete the quality inspection within five minutes. Therefore, we can only inspect samples. This is common practice in our industry."

There are several disadvantages to the sampling method: Firstly, the efficiency of manual testing is relatively low, and the problems of incorrect inspection results and items missing inspection cannot be avoided. Secondly, there is a high degree of dependence on skill and experience. Thirdly, the causes of defects and failures cannot be traced back to their sources, so substantial improvements in other production stages cannot be made.

"To respond to the above issues, we decided to adopt digital technologies such as AI as we felt it would let us apply efficient and intelligent product inspections," says Chen Chao. "After comprehensive evaluation of the options, the technical strength of IIT<sup>1</sup> and FRDC left a deep impression on us, especially due to their rich experience in the field of intelligent manufacturing and their research capabilities in the field of AI. We felt that we would be able to work together well to reach our goals."

### Co-creation of intelligent diagnosis solutions utilizing AI

With a comprehensive grasp of NGC's production status and specific issues, IIT in cooperation with FRDC created a smart diagnosis solution based on the Physical-AI Hybrid Model<sup>2</sup>. FRDC developed and optimized the AI-related algorithms and physical models based on time/frequency domains. Then, using these technologies, IIT provided the customer with overall product development and deployment services for the solutions.

Qin Jian, General Manager of the Strategy Department of IIT, describes the system as using vibration sensors installed on the gearbox to collect real-time, multi-dimensional vibration signal data which it then stores, synchronizes and integrates. Using the Physical-AI Hybrid Model, real-time analysis is carried out on the data detected for different frequency bands. This allows the system to quickly determine whether the product is defective or faulty.

(\*1) INESA Intelligent Technology is a joint venture established in 2018 by Fujitsu (China) Holdings Co., Ltd. and INESA (Group) Co., Ltd.

(\*2) The Physical-AI Hybrid Model, supported by Fujitsu's unique AI technology, can perform high-precision classification and judgement based on an AI model, while using the physical model to explain the AI model results.

(\*3) The knowledge graph constructs a knowledge base in a format that AI can process and visualizes the relationship between different fields of knowledge. Building a reliable digital knowledge base in various fields is the key to ensuring that AI can be used by businesses and society in the future.

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Dr. Sun Jun, Director of the IT Research Department of FRDC, says the following about the Physical-AI Hybrid Model: "Current mainstream AI technology adopts deep learning models to determine whether products are faulty, but cannot explain the basis used for AI judgement. Therefore, the solution is a combination of deep learning and physical models. This combination can not only determine whether products are qualified but can also locate the frequency band of any faults. The hybrid system can then make an initial determination of the cause of the fault. With this information, customers can trust the AI's judgements completely and quickly take the next step."

Chen Chao says, "With the help of our new AI tools, we have been able to change from a manual sampling model to efficient and intelligent full inspection. We have reached a key breakthrough in our quality inspection process."

### Thirty times more efficient inspections Applying AI to a wider field

According to PoC testing, inspection time has been shortened from one hour to two minutes, a thirty-fold increase in efficiency. The detection rate of defects and faults has reached more than 99%. What is more, the AI system can not only locate the faulty frequency band, but can also preliminarily determine the cause of the failure, allowing users to retrospectively trace the issue through the production process, laying a foundation for further optimization and improvement in the future.

IIT and FRDC also plan to build an AI knowledge graph<sup>3</sup> of quality inspection for NGC. This will not only effectively help avoid any aspects of the production process which are prone to failure but will also promote the skill and experience inheritance of the quality inspectors. "Using the AI knowledge graph, we can help the customer build digital industry knowledge bases, so that even when launching new products, they can quickly copy and apply the quality inspection experience." Qin Jian says.

Qin Jian says, "This new platform-based solution will also be used for defect detection and maintenance for robot reducers, vacuum pump units and motors. This can help equipment manufacturing companies significantly improve their operational efficiency and help them take the huge leaps possible with intelligent manufacturing."

Chen Chao says, "In cooperation with IIT and FRDC, we have transformed and upgraded our quality inspection model. NGC will continue to explore ways to innovate and contribute to the creation of a better, more sustainable future for everyone."