1. Dataset overview

1) Statement

XJTUGearbox and **XJTUSuprgear datasets** are provided by the Institute of Aero-engine at Xi'an Jiaotong University (XJTU), Shaanxi, P.R. China (http://iafe.xjtu.edu.cn/jgyjs/hkfdjyjs.htm). These fault diagnosis datasets are publicly available and anyone can use them to verify the diagnosis algorithms. Publications requiring the use of the **XJTUGearbox** and **XJTUSuprgear datasets** cite the following papers.

[1] Tianfu Li, Zheng Zhou, Sinan Li, Chuang Sun, Ruqiang Yan, Xuefeng Chen, "The emerging graph neural networks for intelligent fault diagnostics and prognostics: A guideline and a benchmark study," *Mechanical Systems and Signal Processing*, vol. 168, pp. 108653, 2022. DOI: 10.1016/j.ymssp.2021.108653

2) Data download address

➕ Google Drive:

https://drive.google.com/drive/folders/1ejGZu9oeL1D9nKN07Q7z72O8eFrWQTay?usp=sharing

➕ Baidu Netdisk: https://pan.baidu.com/s/1nyi1CSO9Ox0Oa3DQoP6AnQ

    password: 1234

➕ Code library: https://github.com/HazeDT/PHMGNNBenchmark

3) Contact

If you have any questions or suggestions, do not hesitate to contact:

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2. Data description of XJTUGearbox dataset

2.1 Experimental setup

The experiment platform is depicted in Fig. 1, which is composed of a driving motor, a controller, a planetary gearbox, a parallel gearbox and a brake. Among them, the type of the motor is a 3 Phase and 3 HP motor, and its power supply is a three-phase alternating current (230V, 60/50Hz). Two 1D-accelerometers (**PCB352C04**) are mounted on the X and Y directions of the planetary gearbox to collect the vibration signals, and the signals in Y direction are used. In the experiment, four types of planetary gear failure modes and four types of bearing failure modes are prefabricated on the planetary gearbox. As shown in Fig. 1(b), the gear failures include the tooth surface wear, missing tooth, root cracks and tooth broken. The bearing failures include the ball fault, inner race fault, outer race fault and a mixed fault of the aforementioned three bearing faults. Therefore, together with the normal state, a total of nine kinds of vibration signals are collected. Besides, the motor speed is set to 1800r/min and the sampling frequency is set to 20480Hz during the experiments.

Fig. 1. The test rig of XJTUGearbox Dataset. (a) The test rig; (b) Health conditions of gears and bearings.

2.2 Data file description

The XJTUGearbox dataset includes 9 subfolders, as shown in Fig. 2. As can be seen, the bearing failure is preset on the first stage planetary gear of the planetary gearbox, and the gear failure is preset on the second stage planetary gear of the planetary gearbox. Besides, each subfolder contains 2 txt files, where "Data_Chan1.txt" means the vibration signal collected in Y direction and "Data_Chan2.txt" means the vibration signal collected in X direction.
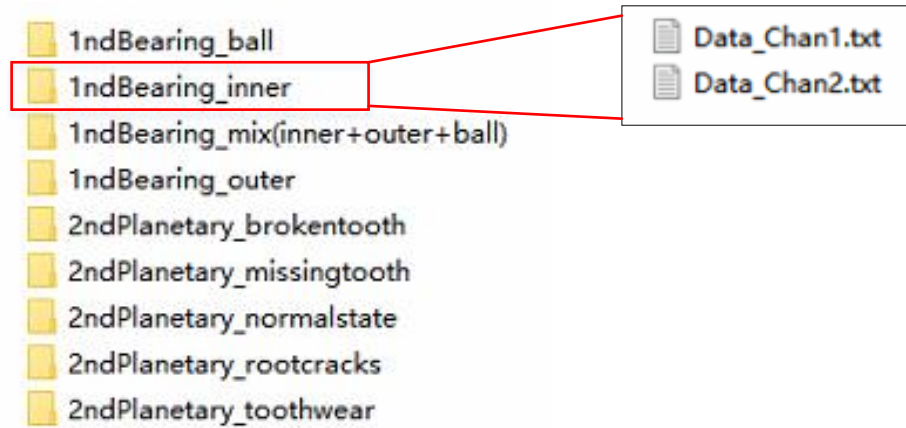
Fig. 2. The contents of XJTUGearbox dataset.

## 2.3 The technical information of XJTUGearbox test rig

The technical information of XJTUGearbox test rig is shown below, and the detailed information can be found in: https://spectraquest.com/drivetrains/details/dds/.

Electrical	
Motor	3 Phase, 3 HP motor, pre-wired self-aligning mounting system for easy installation/removal
Drive	3 HP variable frequency AC drive with multi-featured front panel programmable controller
RPM range	0 to 5000 rpm variable speed
Tachometer	Built-in tachometer with LCD display and one pulse per revolution analog TTL output for DAQ purposes
Voltage	230 VAC, Three phase, 60/50 Hz
Mechanical	
Shaft Diameter	1″ diameter; Turned, Ground, & Polished (TGP) steel
Planetary Gearbox	2-stage, 27:1 gear ratio planetary gear with 4 planet stage1 and 3 planet stage 2
Parallel Gearbox	2 stage, 2.5 maximum ratio per stage, spur or helical gears
Parallel Shaft Gearbox Bearing	Deep groove ball bearing or oil-impregnated bronze sleeve bearing
Bearing Loader	3000lb capacity with force transducer
Torque meter	Up to 20N.m with built-in 360 pulse encoder
Output shaft encoder	360 pulse per turn encoder
Magnetic Brake	1.5 to 32 lb.ft capacity heavy duty magnetic particle brake
Foundation	1/2″ (12.7 mm) die cast aluminum base, base stiffener and eight rubber isolators

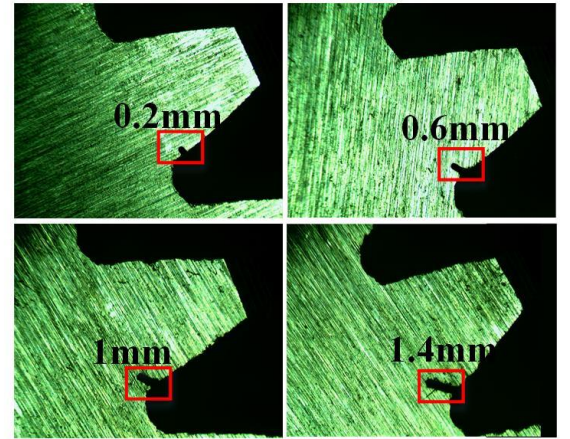# 3. Data description of XJTUSuprgear dataset

3.1 Experimental setup

The experiment platform is depicted in Fig. 3(a), which consists of a driving motor, a belt, a shaft, and a gearbox. Among them, the type of the motor is an AC variable frequency motor, and its power supply is a single-phase alternating current (220V, 60/50Hz). Twelve 1D-accelerometers (**PCB333B32**) are mounted on the gearbox to collect the vibration signals, and the signals of first sensor are used. In the experiment, four types of root cracks with different crack degrees are prefabricated on the spur gear, as shown in Fig. 3(b). Together with the normal state, a total of five kinds of vibration signals are collected. Three different speeds are simulated, that is, 900 r/min, 1200 r/min, and variable speeds from 0 to 1200 r/min to 0. Besides, the sampling frequency is set to 10 KHz during the experiments.
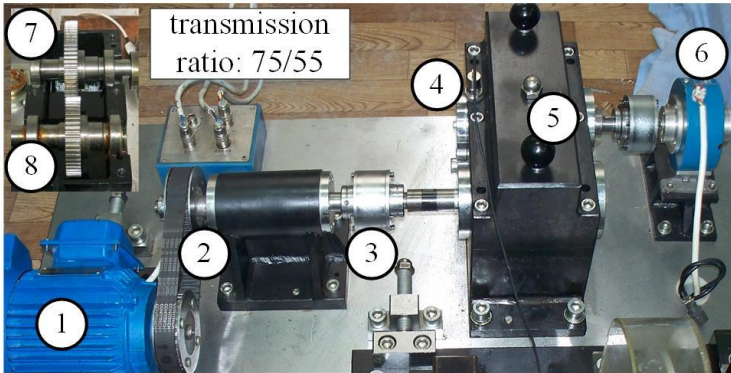
Fig. 3. The test rig of XJTUSpurgear Dataset. (a) The test rig; (b) Health conditions of spur-gears.

3.2 Data file description

As shown in Fig. 4, it can be seen that the XJTUSpurgear dataset includes 3 subfolders, and folder name indicates the two rotating speeds. Besides, each subfolder contains to 5 txt files, where "spurgear02-15.txt" means the crack degree of the tested spurgear is 0.2 mm. Moreover, each txt file contains 14 columns, where the first column denotes the acquisition time and the last column represents speed pulse signal, and the other columns denote vibration signals collected by the 12 accelerometers. The detailed position of the 12 accelerometers is shown in Fig. 5.
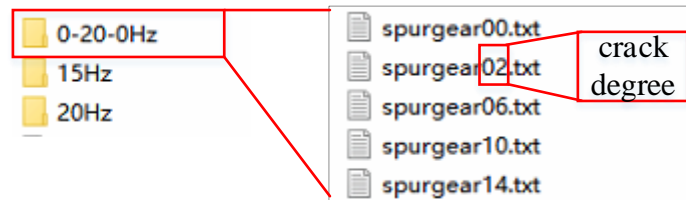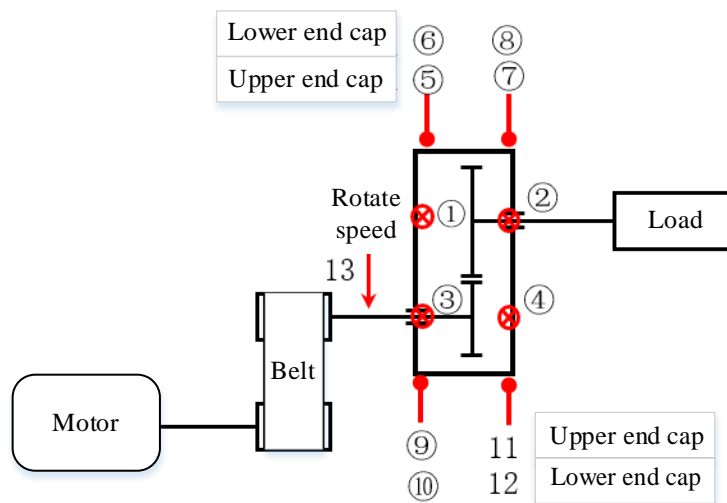
Fig. 4. The contents of the XJTUSuprgear dataset.

Fig. 5. The detailed sensor position.

3.3 The technical information of XJTUSuprgear test rig

The technical information of XJTUSuprgear test rig is shown below.

Component	Type of motor	Rated power	Motor speed	Power supply
Motors	AC variable frequency drive	0.55KW	1390rpm (maximum)	Single-phase alternating current (220V, 60/50Hz)
Gearbox	Module of gear	Number of gear teeth	Gear material	Torque meter
	2	75(big), 55(small)	20CrMnTi steel	5N.m