中岩科技 SINOROCK

安努尔测试实验室 ANNOOR TEST LABS AND ENGG. SERVICES PVT.LTD.

We introduced it for the first time in INDIA

'Non-Contact Bridge Static and Dynamic Deflection Testing Technology in India'

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ATLES

CONTENTS

01 Market and Thoery

1.1 Market Demands
1.2 Traditional Non-contact Methods
1.3 Theory of RSM-FBN(A) Instrument

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Market Demands

India, 2019. 6 killed, 30 injured

America, 2017. Fire cause bridge collapse

Mexico, 2021. 26 killed, 70+ injured

Indonesia, 2011. Repairing error cause deck destroyed

Norway, 2015. Landslide cause bridge collapse

HOW TO AVOID THESE ACCIDENTS?

COMMON POINTS

1.They all generate small displacement before collapse;

2.These displacement was not measured by administrator.

QUESTIONS

1. How to measure displacement of large facilities?

2. How can we guarantee accuracy of measurement?

3. Which measuring method is the most efficient and most economical way?

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Traditional Non-contact Methods

Static level

Vibrating wire displacement meter

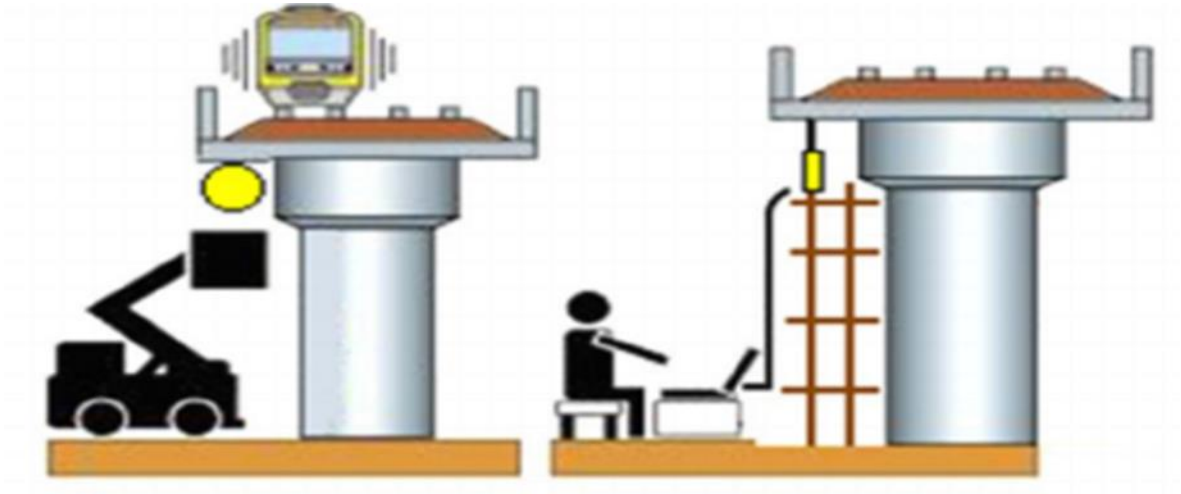
Pull-wire displacement meter

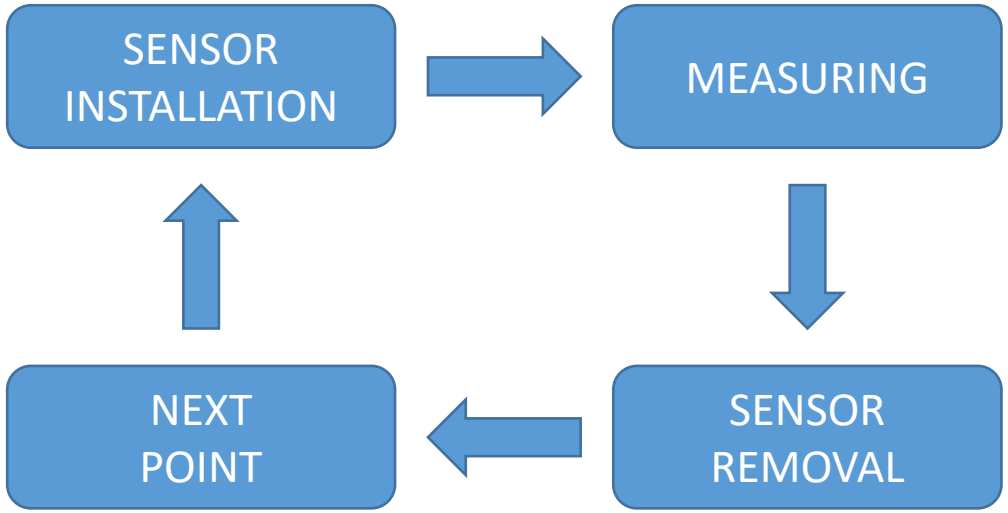
Distributed fiber

Dial indicator displacement gauge

Magneto strictive displacement meter

Traditional Non-contact Methods





Disadvantage of traditional contact methods

1. Installation and removal of sensor wastes time and energy;

2. Sensors are easily broken in bad field working conditions;

3. Single sensor can only measure one-dimensional displacement of one point in a very low measuring frequency;

4. One facility's measurement needs plent of sensors which costs a lot.

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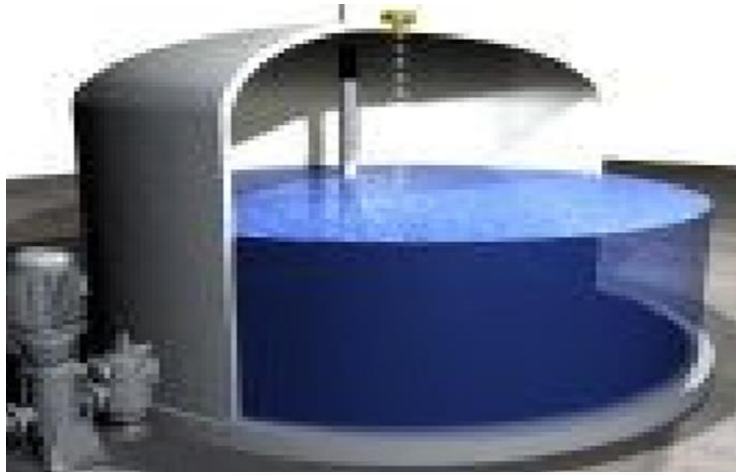
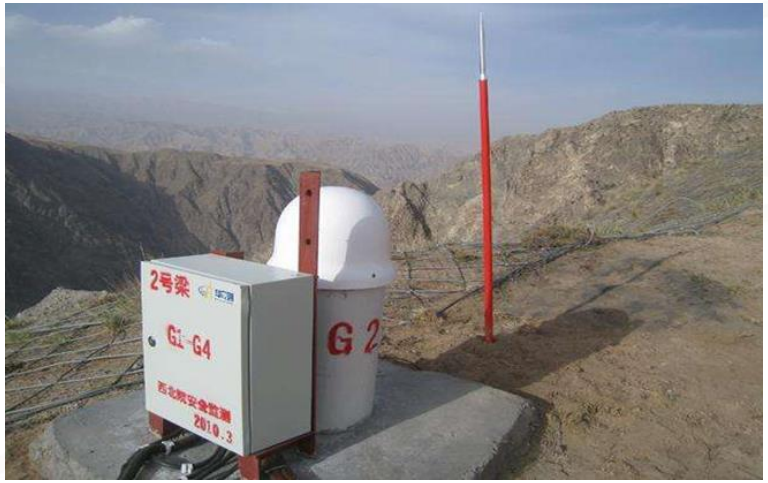
Traditional Non-contact Methods

Total station and Level



Ultrasonic displacement monitoring



RTK and GNSS

Radar displacement monitoring

Disadvantage of traditional non-contact methods

1. Using total station will generates heavy workload for inspector, and takes a long time for inspector,besides human factors contribute a lot in measurement result;

2. Ultrasonic displacement monitoring needs a large and stable reflective surface, has a short measuring distance and low accuracy;

3. GNSS instrument is very expansive which running depends on local networking;

4. Radar’s accuracy is very low and instruments are expensive.

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New Methods Non-contact Optical Measurement

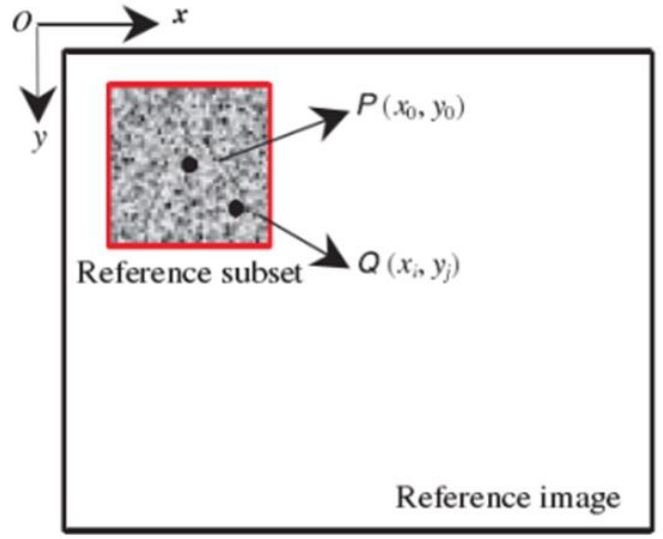
RSM-FBN(A)

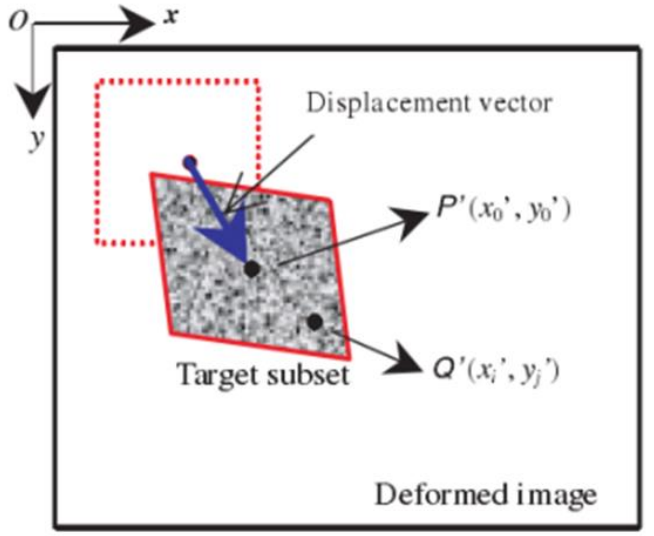
Non-contact Bridge Static and Dynamic Deflection Tester

Through the most advanced image quality assessment algorithm, image quality enhancement algorithm and fast camera self-calibration technology, the RSM-FBN (A) non-contact bridge static and dynamic deflection tester can quickly measure the high-precision dynamic and static deflection, displacement and vibration at multiple points of such facilities as bridges, towers and hoisting machinery in real time through a main machine without any marks on site. The software system matched with the instrument has the functions of guided operation, automatic data recording, automatic calibration, intelligent point selection, real-time output, ultra-limit alarm and safety assessment. The instrument is designed integrally and equipped with military grade sensors and connectors, so it can be used intuitively, simply and conveniently on site.

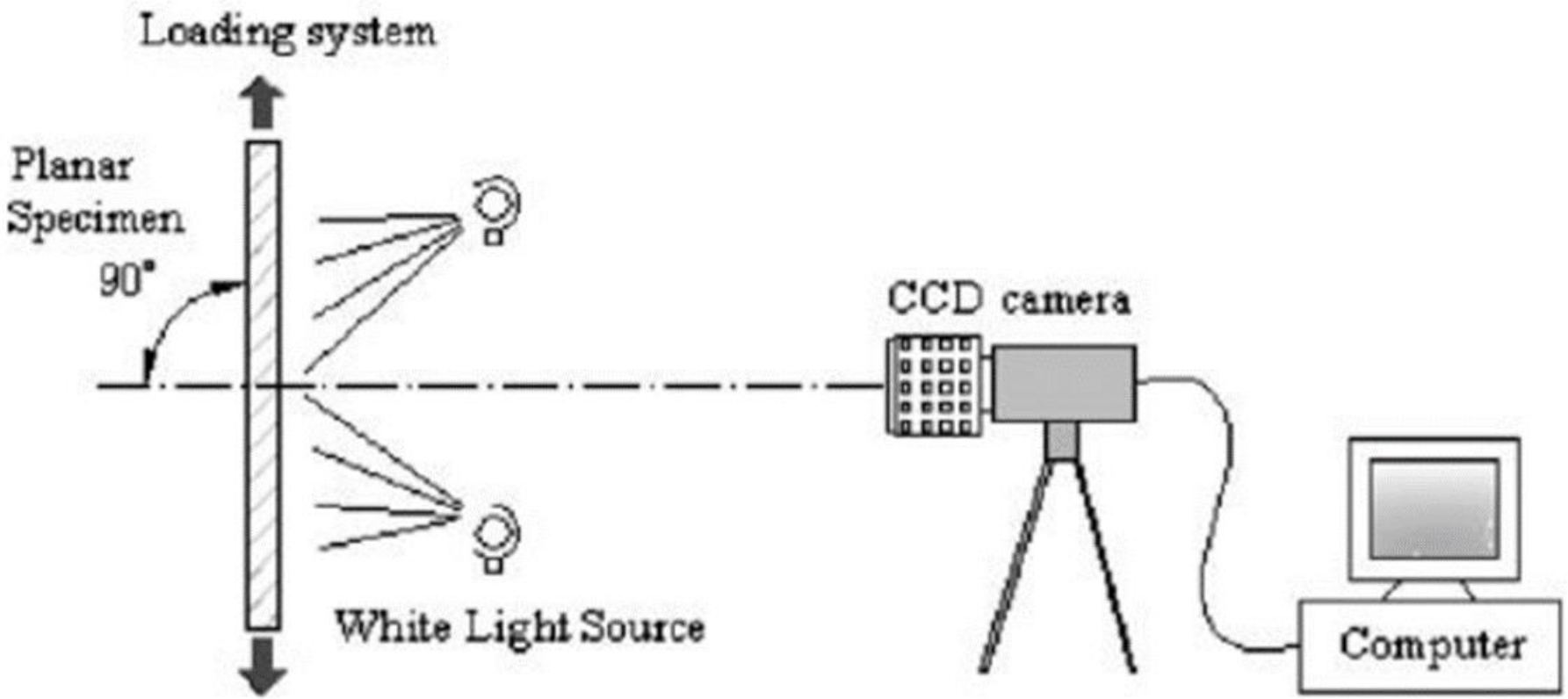
Theory of design

Image vision technology(IVT) is to use machines instead of human eyes for measurement and judgment. It is a comprehensive technology. A non-contact, full-field deformation digital image correlation method based on digital image processing and numerical calculation is used to measure the deformation of the surface of a large structure through two images before and after the deformation. This measurement method can be used to perform the measurement of the object under test. Long-distance, multi-point dynamic and static deformation detection.





Component of measuring system



Core Technologies

Image acquisition

The visual image and inherent characteristics of the target are converted into a series of data that can be processed by a computer;

Image processing

Image processing includes image filtering, enhancement, edge extraction, feature extraction, image recognition and understanding, etc.

System calibration

System calibration is the process of determining the transformation relationship between the space coordinate system and the camera image coordinate system, as well as the internal and external parameters of the camera

Operation

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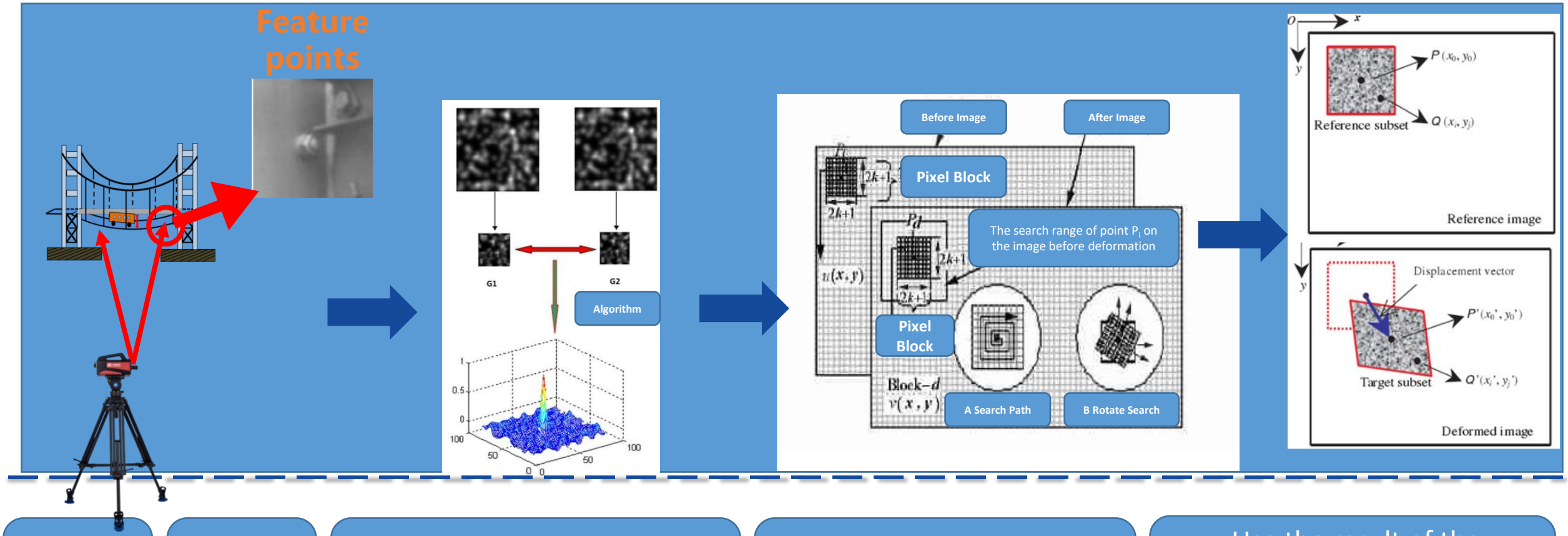

Capture image → Image process → Image matching based on digital correlation coefficients → Calculate the displacement of pixels on the image → Use the result of the calibrated pixel equivalent to get the actual deformation

Theory of RSM-FBN(A) Instrument

Image process algorithm

- Improve image quality
- Increase test distance
- Enhance adaptability in outdoor

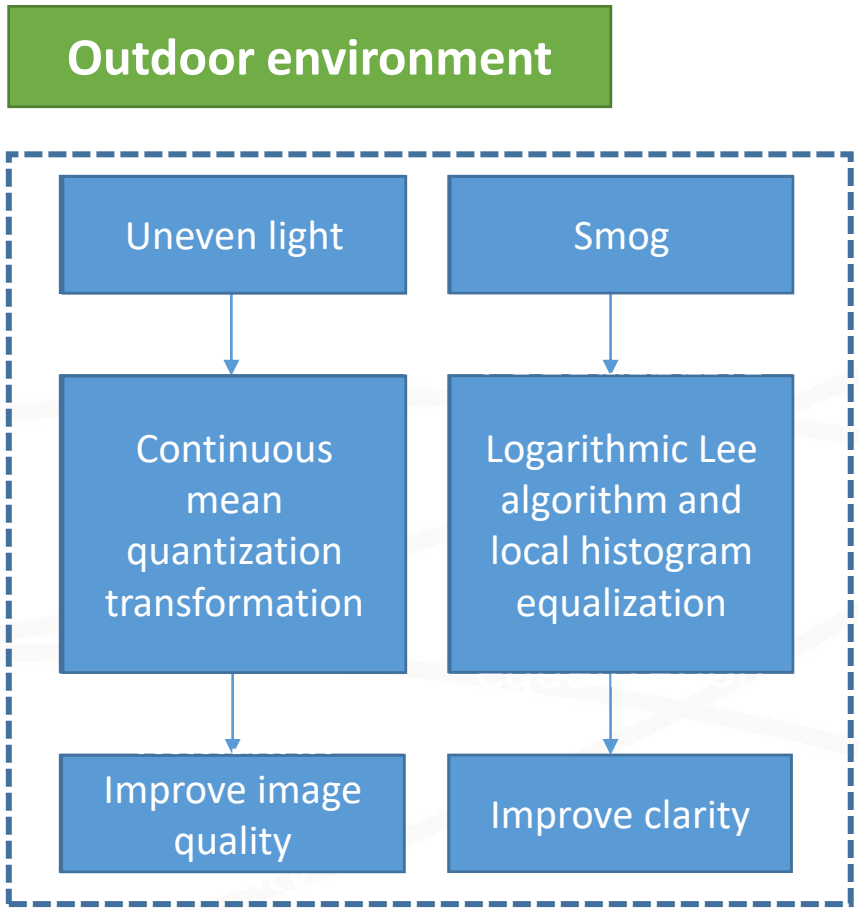

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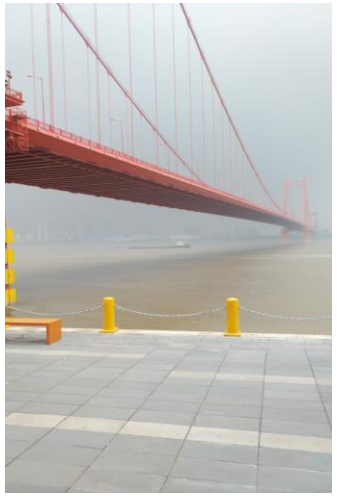
Image process algorithm

Before process

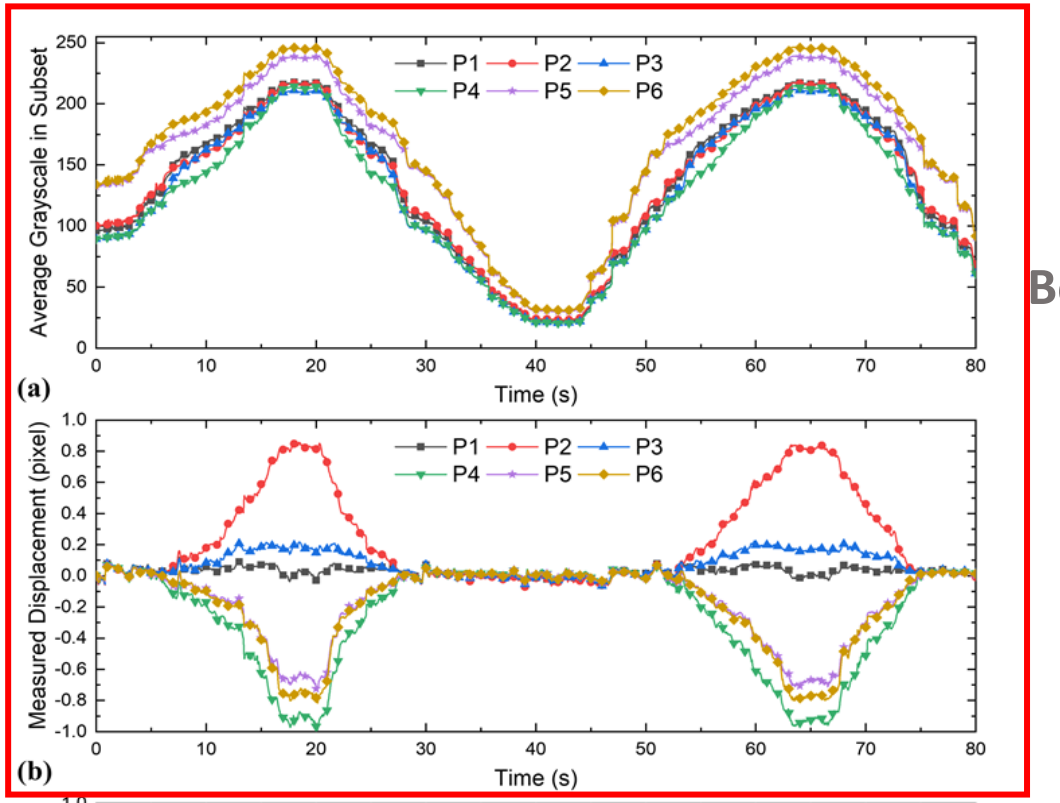
After process



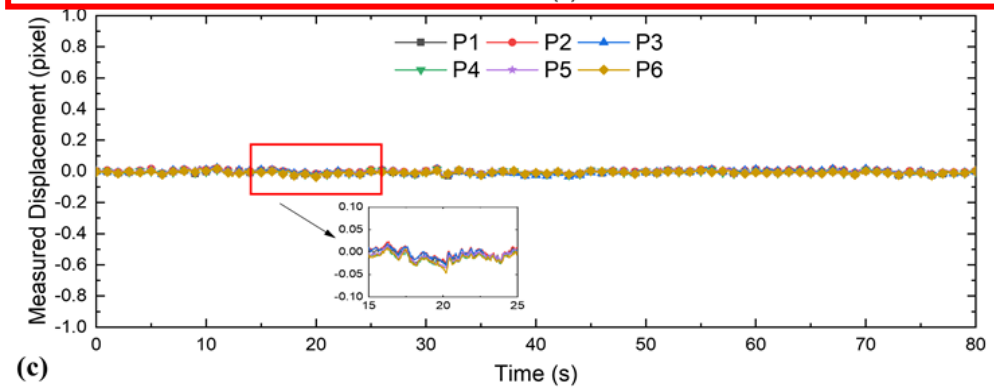
Before process

After process

Theory of RSM-FBN(A) Instrument



Before process



After process

02 Instrument Introduction

2.1 Instrument Introduction

2.2 Parameters

Instrument Introduction

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RSM-FBN(A) Non-contact Bridge Static and Dynamic Deflection Tester

Non-contact Optical Measurement

Application / Test the dynamic/static displacement detection of such large facilities as bridges, towers and hoisting machinery, and can also be used for long-term monitoring of buildings, tunnels, dams and slopes.

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Applicable Standards

- *Highway Bridge Load Testing Procedures (JTG-T-J21-01-2015)*
- *Technical Code for Monitoring of Building and Bridge Structures (GB50982-2014)*
- *Code for Engineering Surveying of Urban Railway System (GB／T 50308-2017)*
- *Code for Engineering Surveying (GB 50026-2016)*

Participating Specifications

Technical Specification for Bridge and Tunnel Structure Safety Monitoring(DB4201/T 624-2020)

Technical code for monitoring and measurement of soft rock tunnel(T/CSPSTC40-2019)

Patent

ZL201910892014.1　　ZL 201810561558.5

ZL202030753400.6

High precision

The instrument realizes the real-time calculation of 0.001mm-level high-precision displacement data through the unique fast self-calibration technology and by combination of attitude sensor, tangential and normal information of object surface.

High Frequency

Synchronous high-frequency measurement at 300Hz on 40 points is realized by using professional-grade industrial camera and combination of special data processing and data transmission technology under the condition of ensuring measurement precision.

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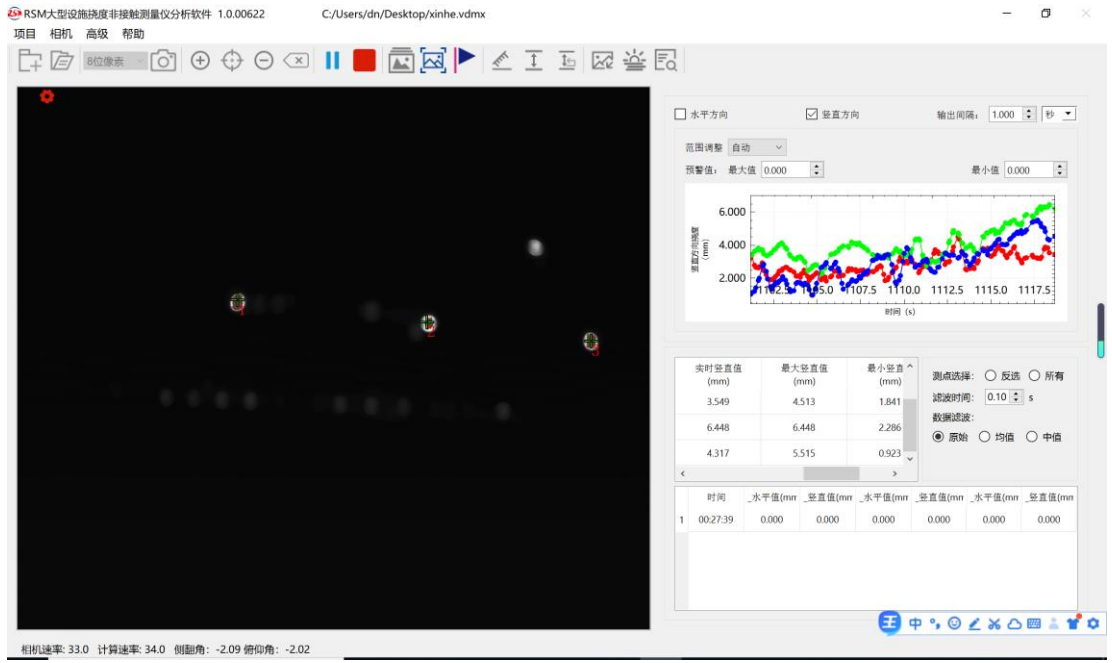
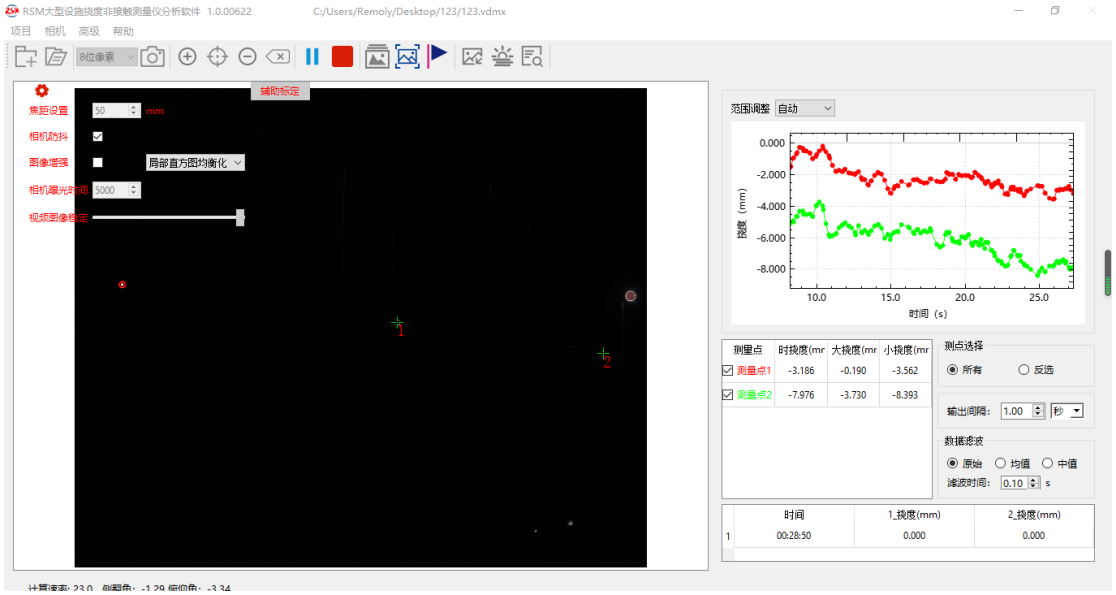
Large Visual Field

The instrument adopts a method of evaluating criterion based on image sharpness to remove the influence of such factors as sunlight/shadow and smog on image quality, adaptively improve and enhance the image quality, and meet the requirements of 1,000m long-distance measurement by combination of professional-grade lenses.





Multiply Functions

The filtering function is perfect, through which the collected curves are pre-processed and post-processed. Multiple functions, such as impact coefficient, damping ratio, spectrum analysis and ultra-limit alarm are readily available. Images can be recorded first, and then processed and analyzed, which is convenient and quick.

RSM-FBN(A) Large Facilities' Non-Contact Deflectometer		
Test Range	0.01m ~ 1000m	
Field of View （FOV）	0.01mm ~ 500m	
Measurement Resolution	0.005mm （0.001mm *customized*）	
Measurement Accuracy	±0.02mm （10m）； ±1mm （100m）； ±10mm （500m）；	***customized*:** **±0.016mm （10m）；** **±0.7mm （100m）；** **±5mm （500m）；**
Sampling Frequency	0~1000Hz	
Lens Focal Length	16mm/25mm/50mm/75mm	
Test Mode	Real-time Test or Video Test	
Dynamic Test Points	40 Points @ 300Hz	
Static Test Points	Unlimited	
Host Weight	3kg	

Standard Configuration

RSM-FBN(A) Non-contact Bridge Static and Dynamic Deflection Tester

 Host	 USB3.0 data transmission line	 Lens (50mm)	 Tripod
 USB flash disk	 Power adapter	 Rangefinder telescope (100m，±7mm)	 Laser rangefinder （1500m，±3m）
 Tripod head of rangefinder	 Small phillips screwdrive	 Instrument box	

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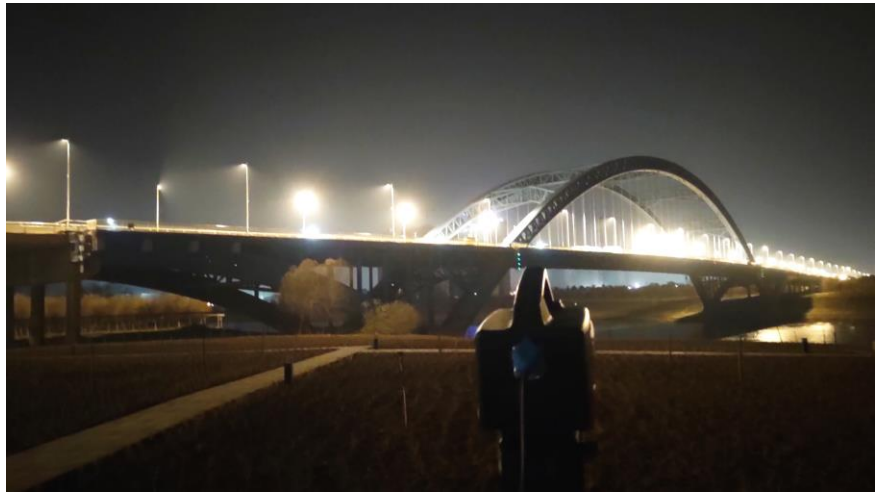
Market application

WISCO (95.1m 261t)

Wuxue Yangtze River Bridge



Changfeng Bridge

On-site project——Wuhan Changfeng Bridge

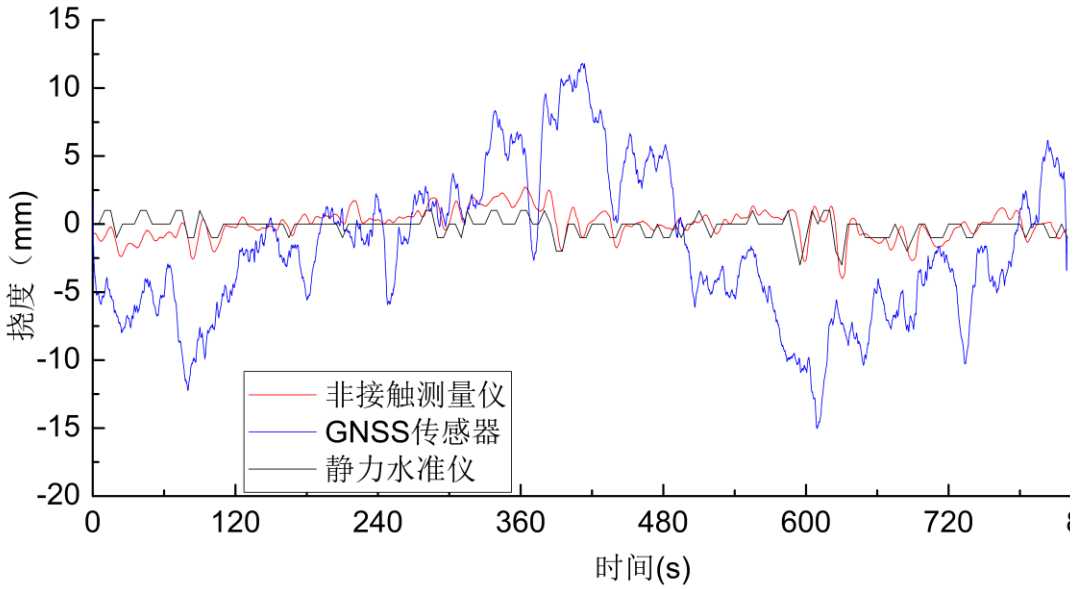
RSM-FBN(A)

Static level

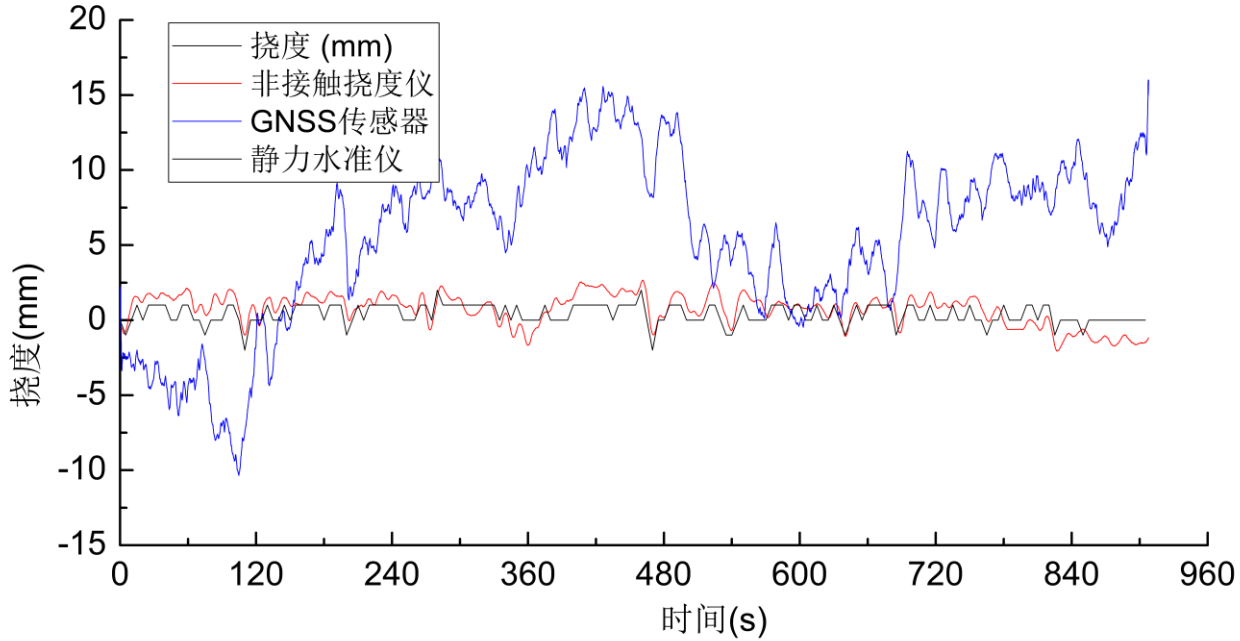
GNSS

On-site project——Wuhan Changfeng Bridge

On-site project——Wuhan Changfeng Bridge



NO.1 Data comparison



NO.2 Data comparison

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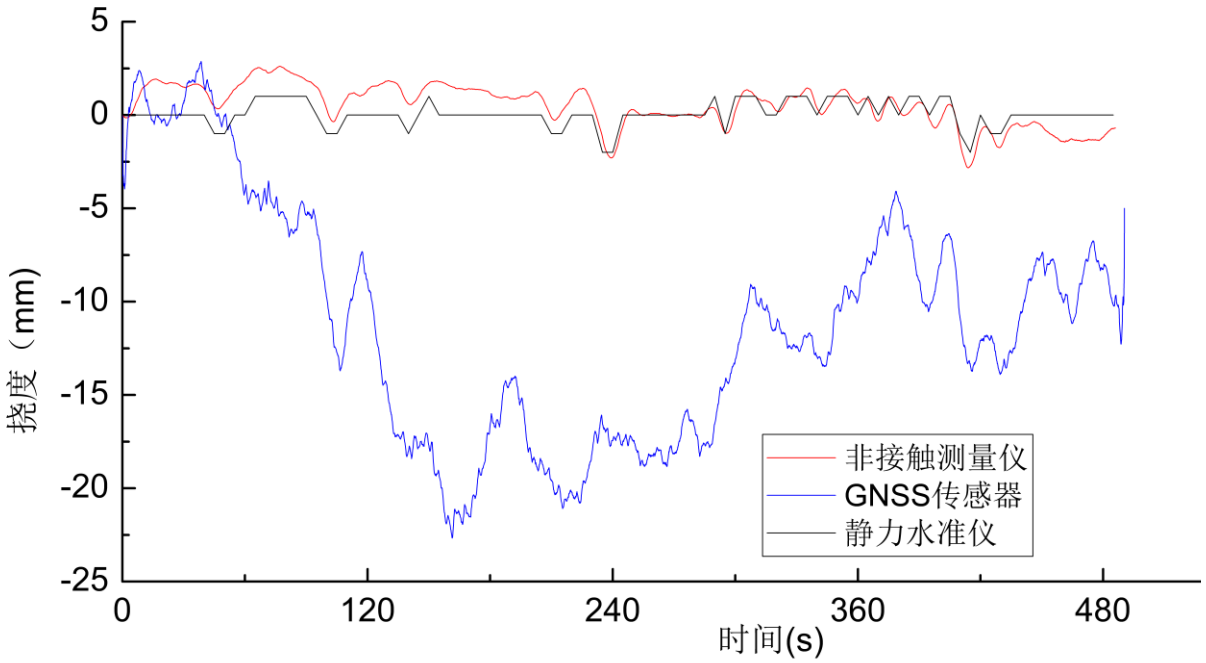
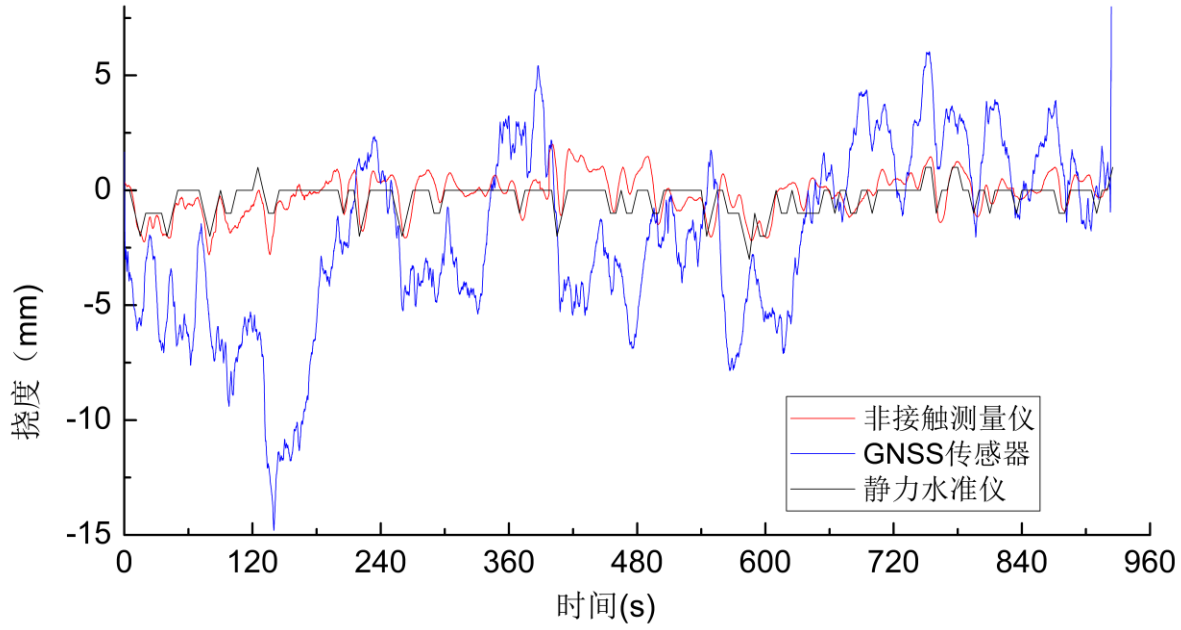
On-site project——Wuhan Changfeng Bridge

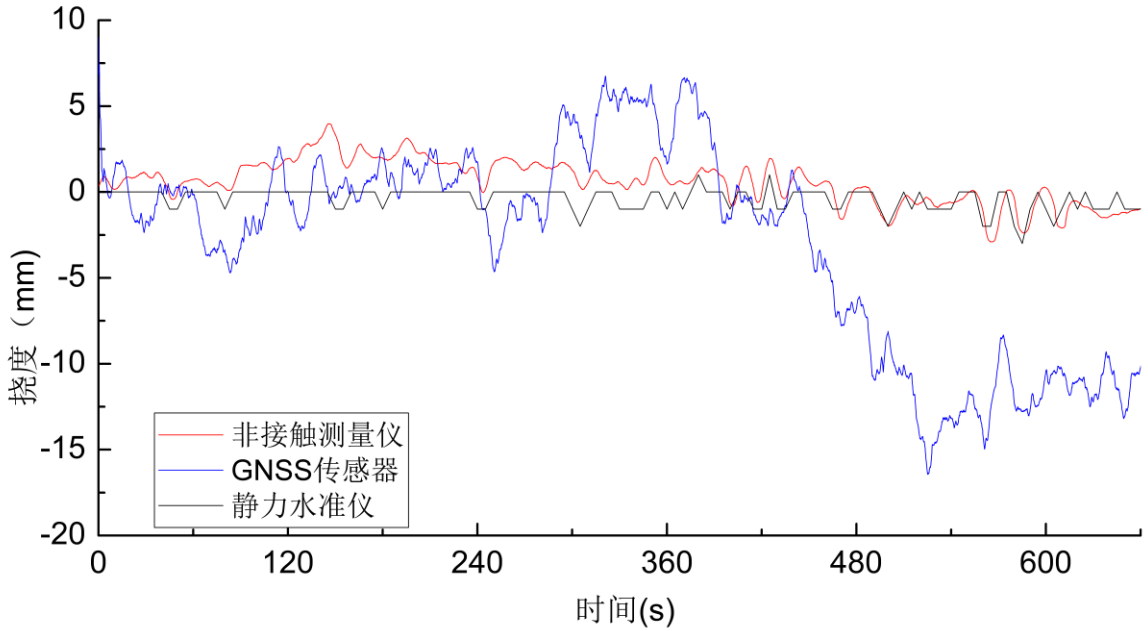


NO.3 Data comparison

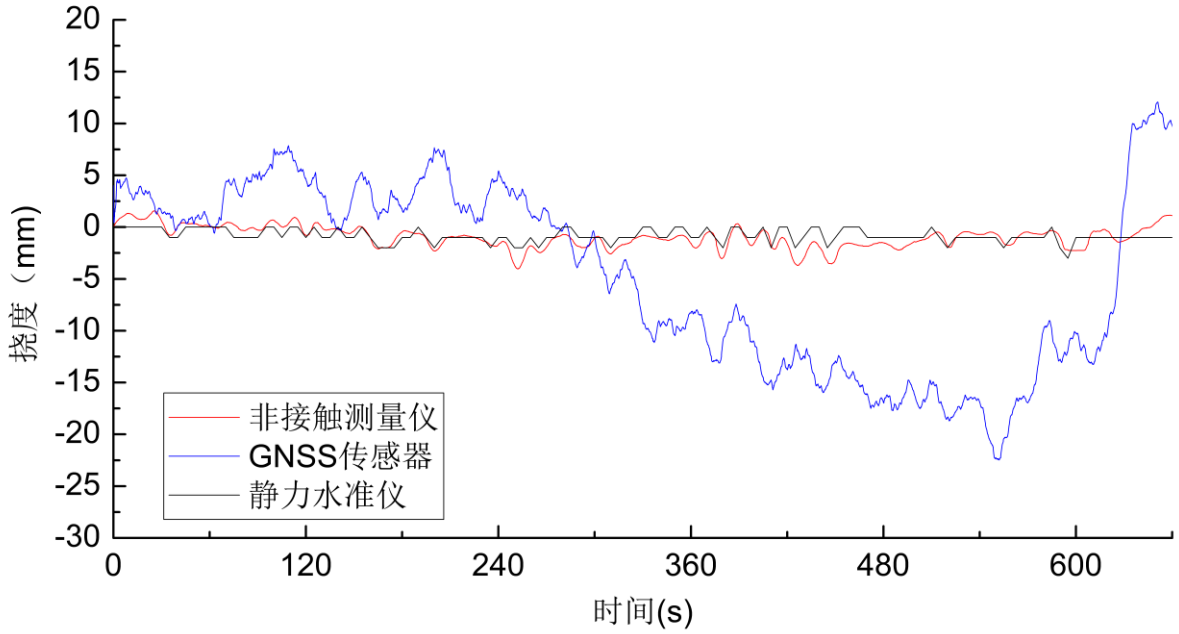


NO.4 Data comparison

On-site project——Wuhan Changfeng Bridge



NO.5 Data comparison



NO.6 Data comparison

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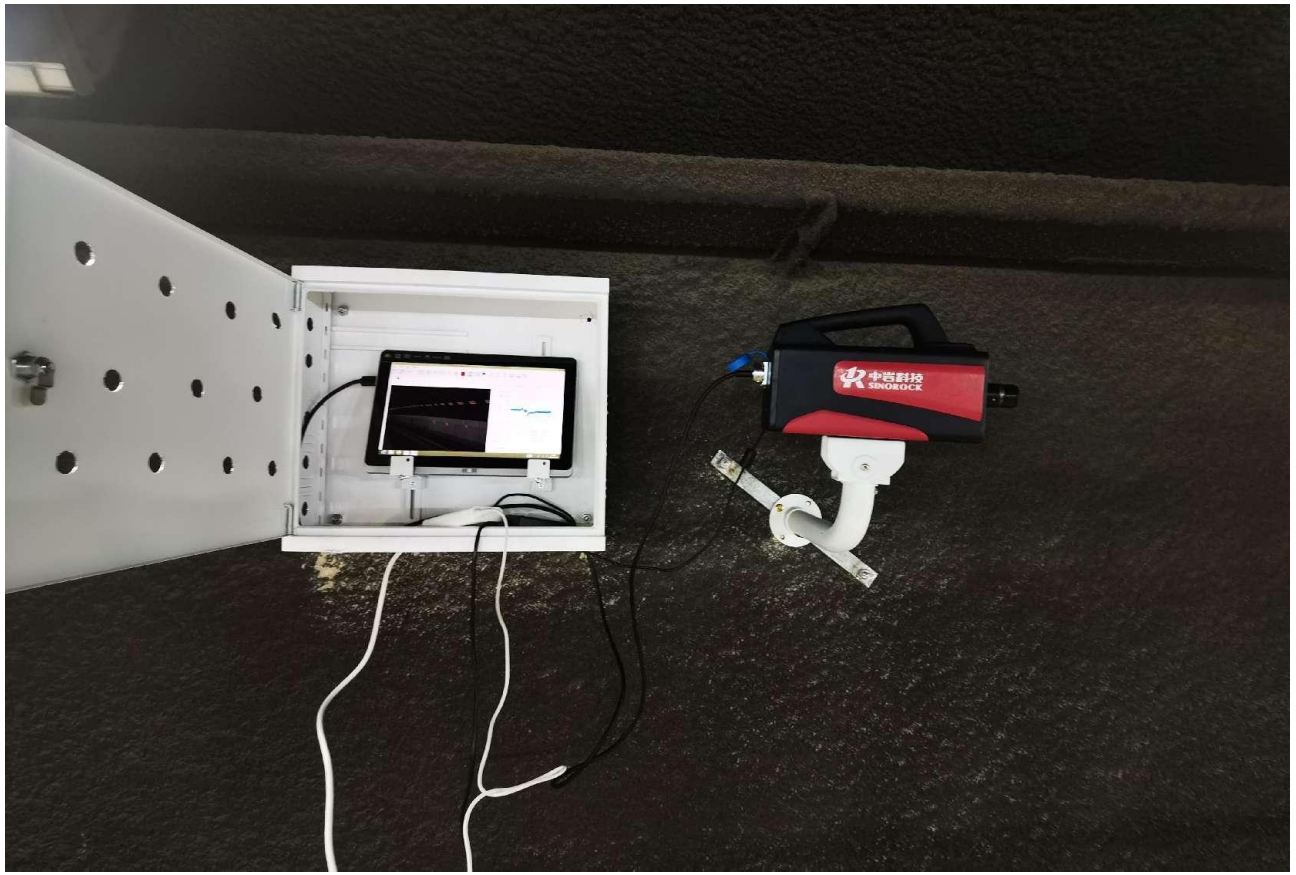
On-site project——Yangtze River Tunnel



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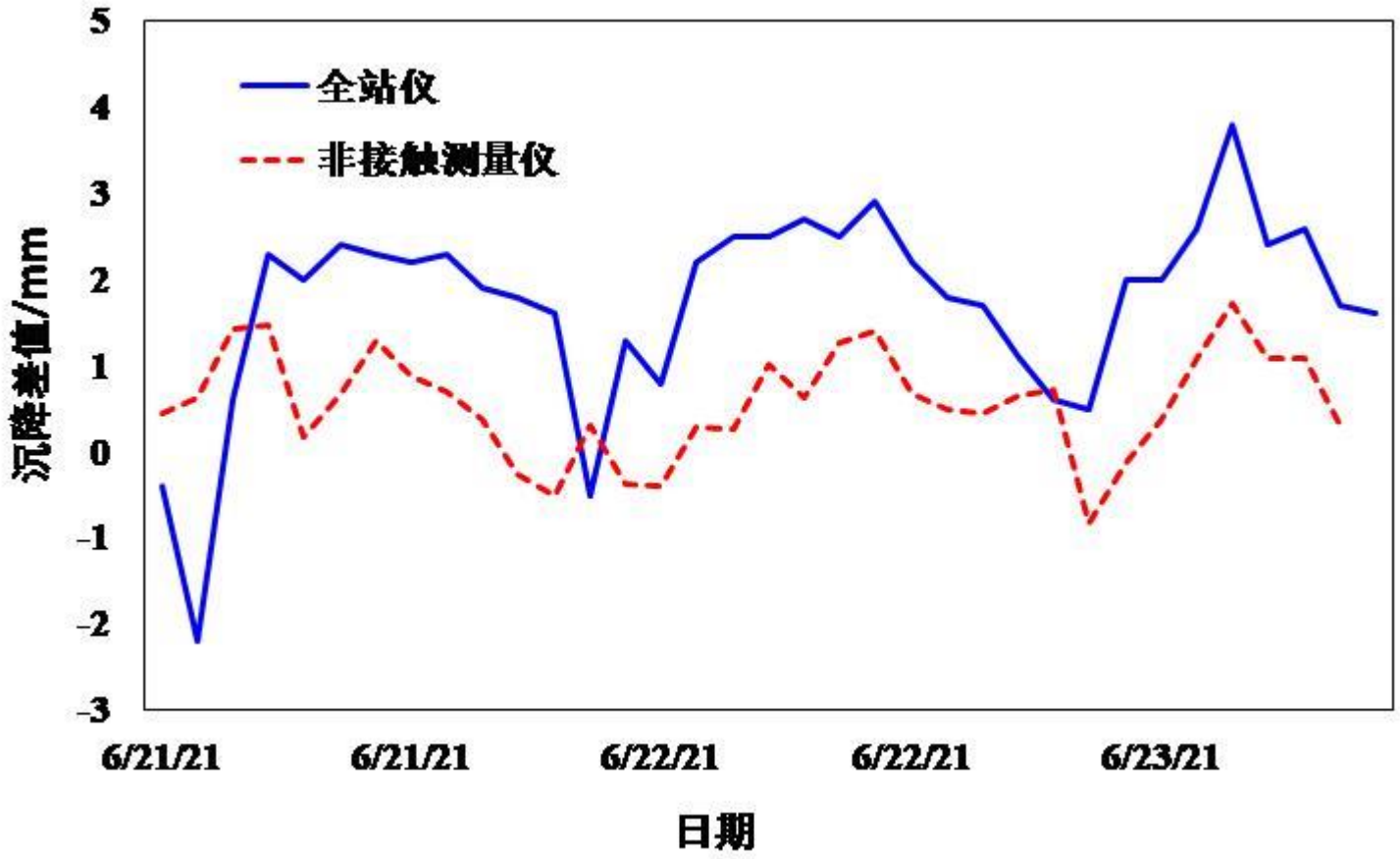
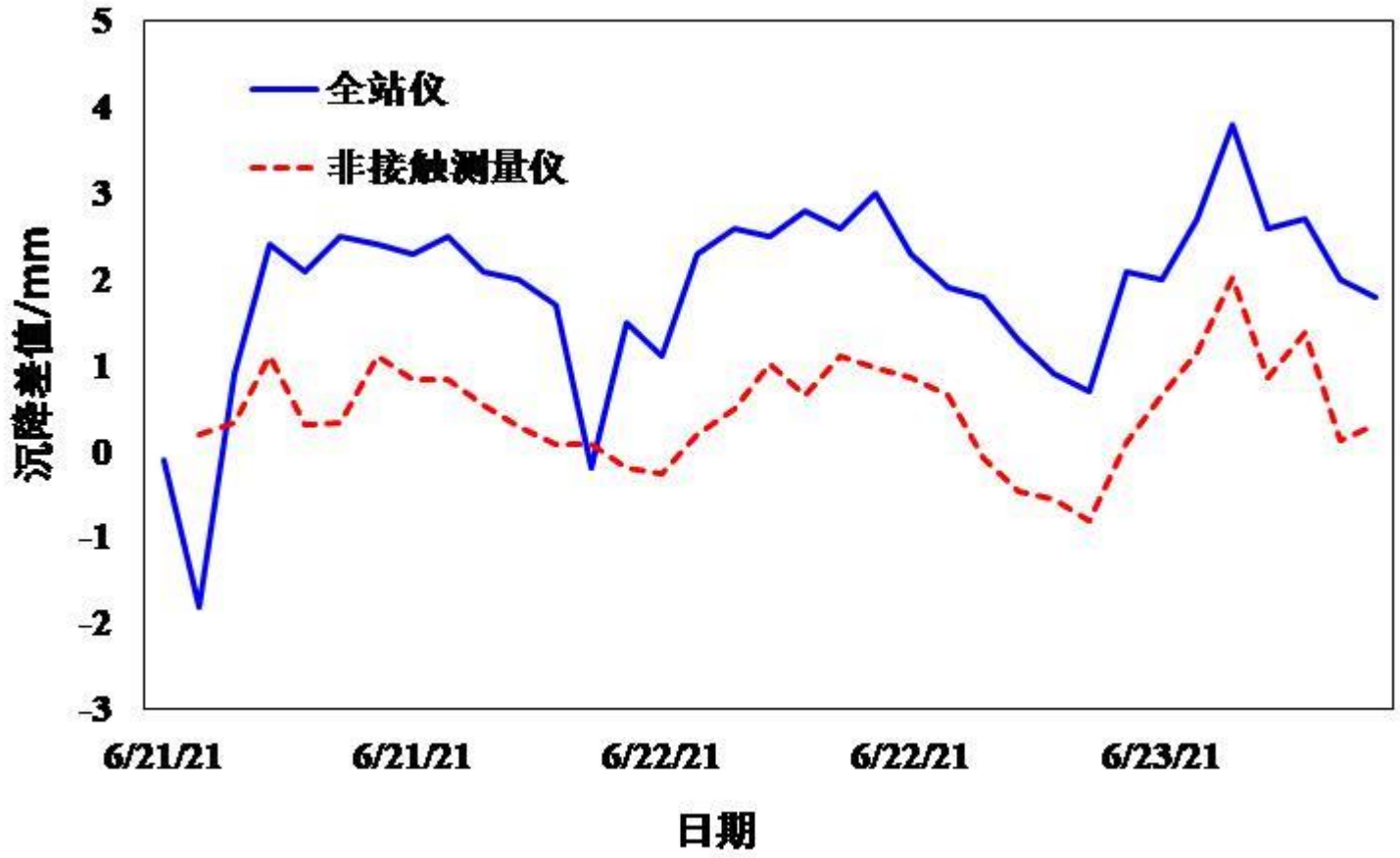
On-site project——Yangtze River Tunnel

On-site project——Yangtze River Tunnel



TEST POINT 1:Data comparison

On-site project——Yangtze River Tunnel



TEST POINT 2: Data comparison

03

Application

3.1 Application
3.2 Operating Process
3.3 Project Case

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Application

Research institutes

Academy

Comprehensive Study

Bridge

Tower

Tunnel

Hoisting Machinery

Test

Construction unit

Test unit

Test

Bridge

Hoisting Machinery

Short term load

Monitor

Tower

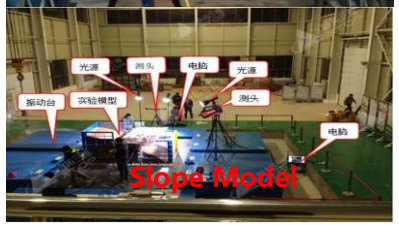
Tunnel

Bridge

Slope

Rail

Long term load



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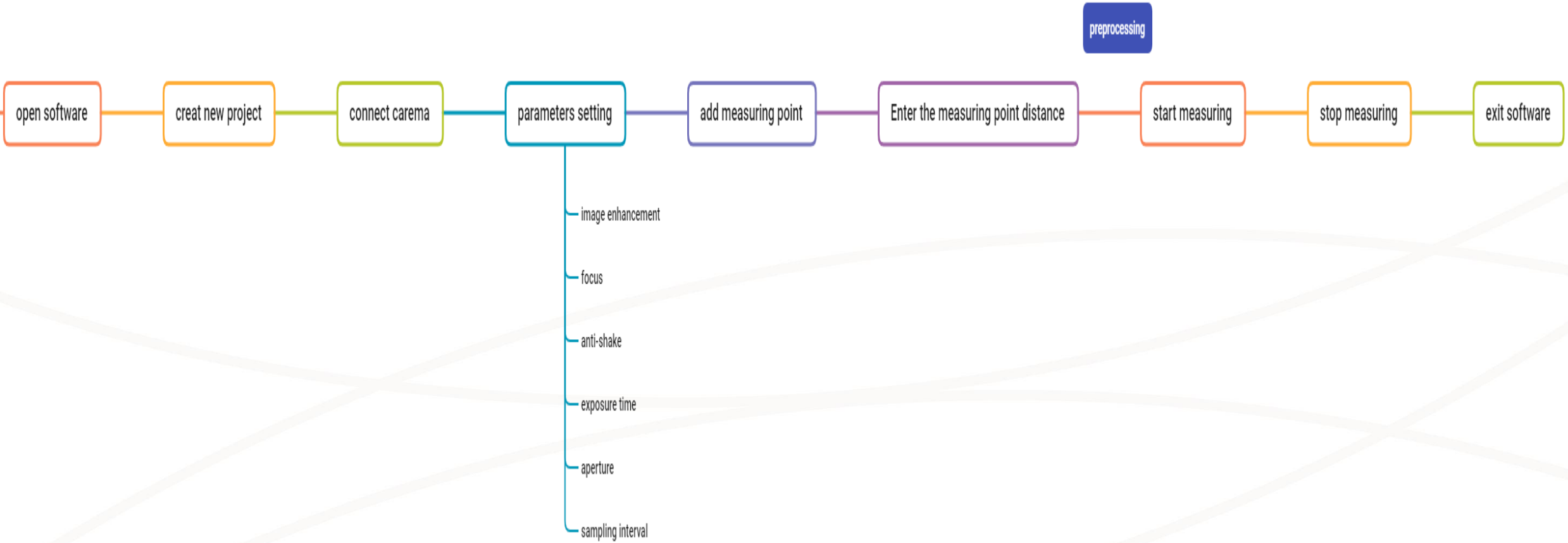
Operating Process



Raw data

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fft_data	2022/3/15 9:53	Microsoft Excel ...	10 KB
Impact_coefficient_Y	2022/3/15 9:53	Microsoft Excel ...	1 KB
psd_data	2022/2/24 15:56	Microsoft Excel ...	70 KB
Raw_data	2022/4/8 15:41	Microsoft Excel ...	829 KB
StaticMeasurmentData	2022/1/26 8:53	Microsoft Excel ...	1 KB
X_1	2022/1/26 8:56	Microsoft Excel ...	1,183 KB
Y_1	2022/1/26 8:56	Microsoft Excel ...	1,200 KB

A1 | Time

	A	B	C	D
1	Time	Duration(s	Raw(mm)	Output(mn
2	2022/1/26 8:53	5.044	0.007	0.007
3	2022/1/26 8:53	5.049	-0.001	-0.001
4	2022/1/26 8:53	5.054	-0.002	-0.002
5	2022/1/26 8:53	5.059	0	0
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13	2022/1/26 8:53	5.102	-0.001	-0.001
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15	2022/1/26 8:53	5.113	-0.003	-0.003
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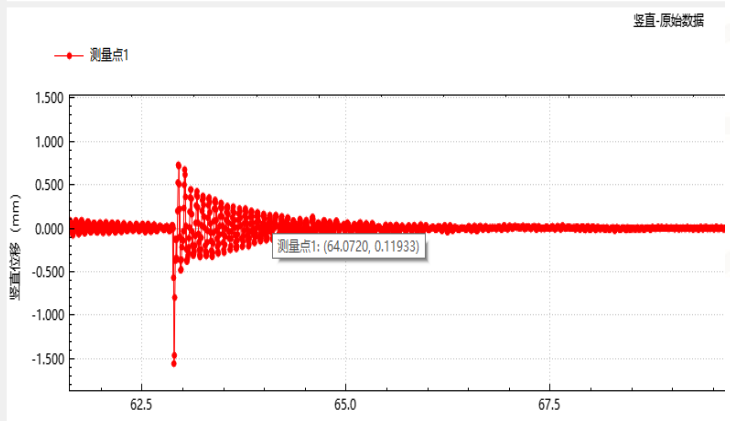

桥梁检测报告首页

委托单位		合同编号	
工程名称			
设计单位			
施工单位			
监理单位	/		
管理单位			
结构形式			
检验项目			
竣工时间		检测时间	
检测依据	（1）《公路桥涵养护规范》（JTG H11—2004） （2）《公路钢筋混凝土及预应力混凝土桥涵设计规范》（JTJ 023—85、JTG D62-2004） （3）《公路桥涵地基与基础设计规范》（JTJ 024—85、JTG D63-2007） （4）《公路桥涵设计通用规范》（JTJ 021—89、JTG D60—2004） （5）《公路工程质量检验评定标准》（JTGF80/1-2004） （6）《公路桥梁技术状况评定标准》（JTG/T H21—2011） （7）《公路桥梁承载能力检测评定规程》（JTG/T J21-2011） （8）《钻芯法检测混凝土强度技术规程》（CECS03-2007） （9）本桥设计、施工资料		
判定依据	（1）《公路桥梁技术状况评定标准》（JTG/T H21—2011） （2）《公路桥梁承载能力检测评定规程》（JTG/T J21-2011）		
主要仪器设备及编号			
检验结论	见附件结论。 （盖章）		
备 注	具体见附件。		

编写： 审核： 签发：

4.2 跳车试验

跳车位置	最大位移(mm)	冲击系数
10		
20		
30		
40		
50		
60		
70		
80		

时程曲线

1）10公里跑车

2）20公里跑车

3）30公里跑车

4）40公里跑车

5）50公里跑车

6）60公里跑车

7）70公里跑车

8）80公里跑车

Dynamic test report

4.4 梁体自振频率（人工选取选取跳车或刹车较为明显的波形）

竖向自振频率	阻尼比	衰减系数

频谱图

注·意·事·项

1、检验报告无“检验专用章”无效。
2、检验报告无编制、审核、批准人员签字无效。
3、检验报告涂改无效。
4、未经书面许可不得复制报告（完整复制除外），复制的检验报告未重新加盖“检验专用章”或“委托检验专用章”无效。

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Thanks!