



新能源基础设施防灾与新型测试技术研究的初步进展

-同济大学校庆学术汇报会

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Outline

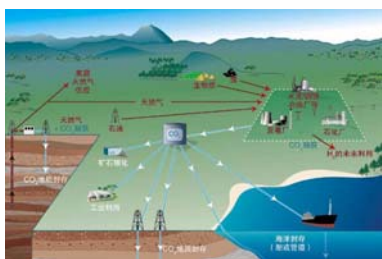
- 新能源基础设施防灾
 - CO₂地质封存监测
 - 风电塔架结构安全
- 新型测试技术
 - 激光扫描(LiDAR)
 - 激光测振(LDV)

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CO₂ storage

Introduction

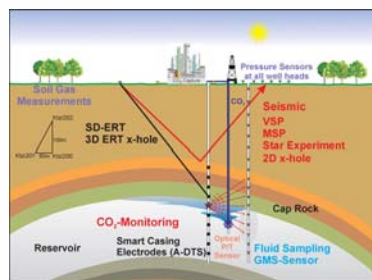


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CO₂ storage

Monitoring techniques

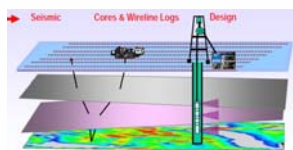


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CO₂ storage

Traditional seismicity

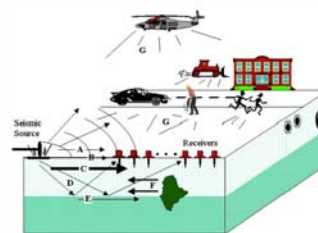


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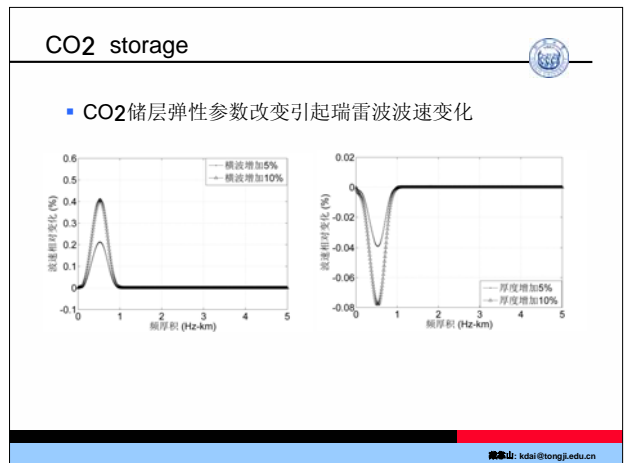
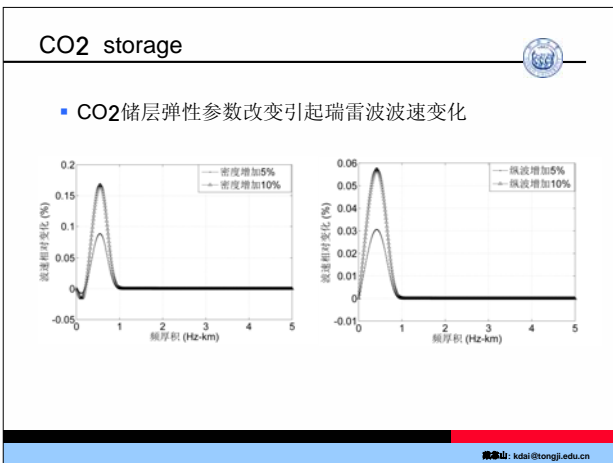
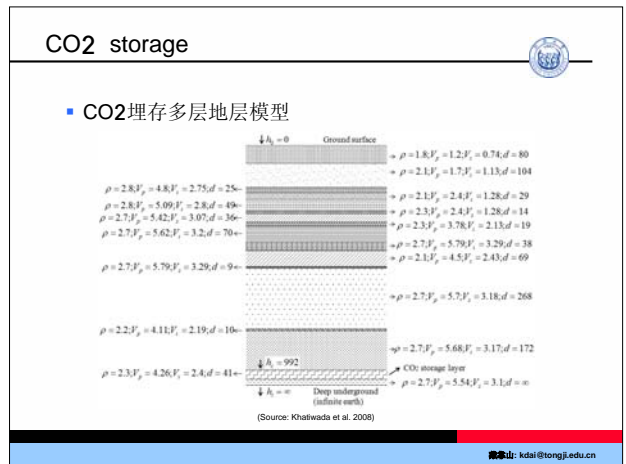
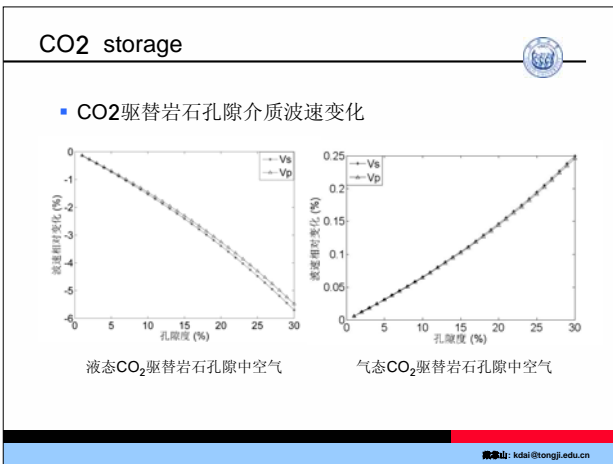
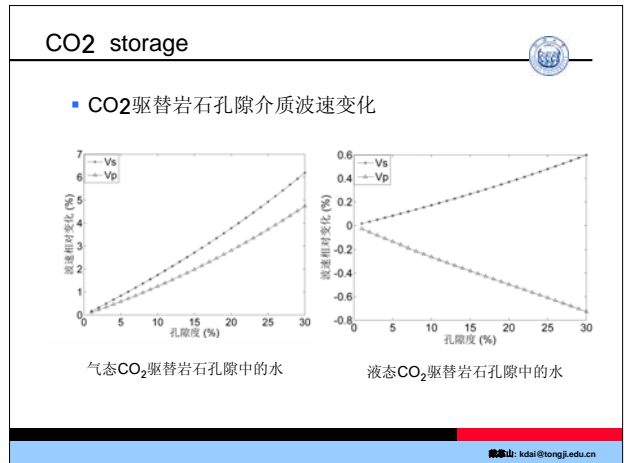
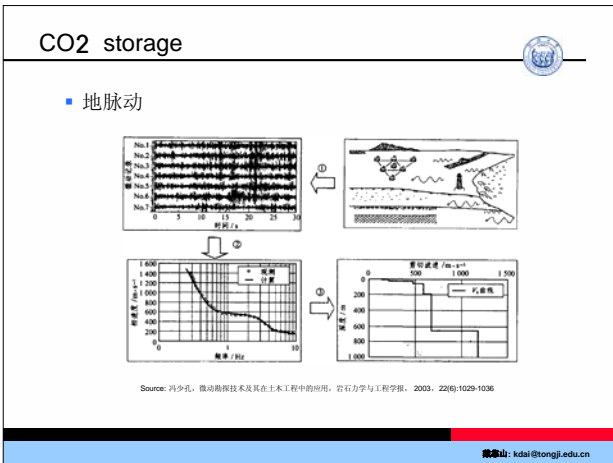


CO₂ storage

Passive seismicity

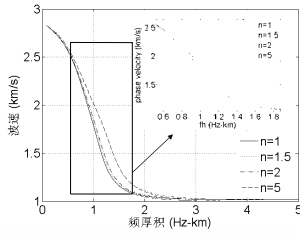


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CO₂ storage

- CO₂储层层厚比改变引起瑞雷波波速变化



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CO₂ storage

- 在岩石孔隙率变化30%范围内, CO₂注入引起的波速变化大概在10%以内;
- 面波波速对CO₂储层横波速度变化相对敏感, 而对CO₂储层密度、层厚和纵波速度变化不敏感;
- CO₂埋深浅且储层厚时, 储层物理参数改变对面波波频散特性影响大; CO₂埋置较深但储层较薄时, 储层物理参数改变则对面波波速影响小;
- 数值模拟研究初步表明, 当CO₂埋藏深度较深且储层厚度较薄时, 常规地脉动分析方法对CO₂地质存储进行监测难度较大。

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Wind turbine tower

- Introduction



Source: 李俊峰等2011

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Wind turbine tower

- 传统塔架运输和安装

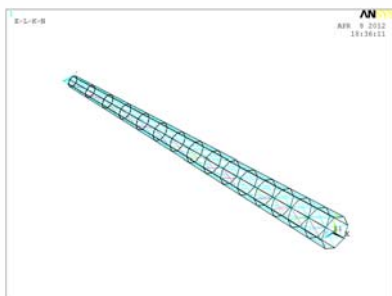


Source: 李俊峰等2011

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Wind turbine tower

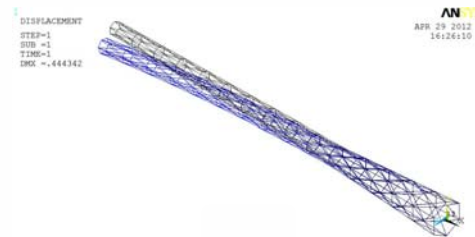
- Structural analysis-FE model



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Wind turbine tower

- Structural analysis-displacement

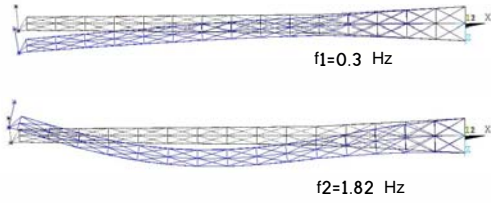


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Wind turbine tower



- Structural analysis–modal analysis

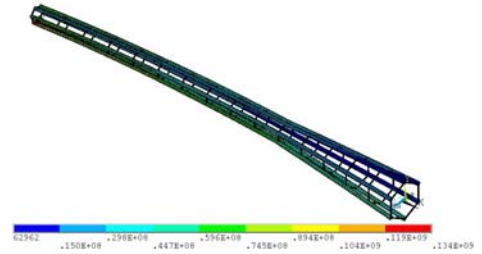


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Wind turbine tower



- Structural analysis–stress analysis



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Wind turbine tower



- 结构性能不同于传统锥形筒塔;
- 塔架抗震减振技术的研究;
- 塔架健康监测系统研究;

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Sensing technology



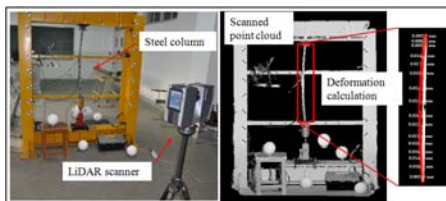
- Non-contact sensors
 - LiDAR
 - Laser vibrometer

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LiDAR



- LiDAR scanning testing to obtain structural deformation and stress

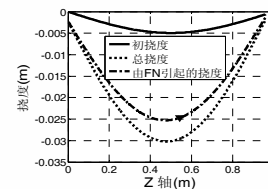


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LiDAR



- Displacement results



TLS 模型结果(mm)	LVDTs结果(mm)	相差(mm)	相差(%)
24.7	24.5	0.2	0.82

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LiDAR

- Strain results

拉应变计算值	拉应变测量值	相差	相差 (%)
0.0013	0.0014	0.0001	7.14
压应变计算值	压应变测量值	相差	相差 (%)
0.0015	0.0017	0.0002	11.76

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Laser vibrometer

- Free vibration testing of a bolted beam

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Laser vibrometer

- Two laser devices for vibration measurement

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Laser vibrometer

- Comparison with F analysis

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Laser vibrometer

- Girder vibration testing in the new structural lab on the Jiading campus

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Laser vibrometer

- Reaction wall vibration

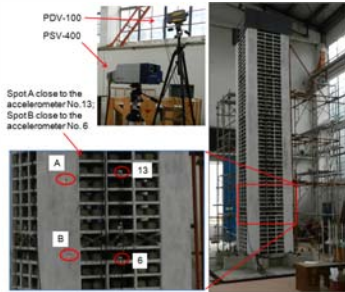
Method	Laser	Seismometer	Difference
Results	14.27 Hz	13.81 Hz	3.3%

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Laser virometer



- LDV application in a shaking table test

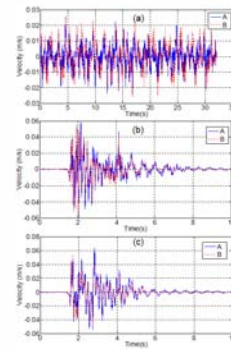


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Laser vibrometer



- Structural vibrations of the high-rise building model under different shaking table excitations

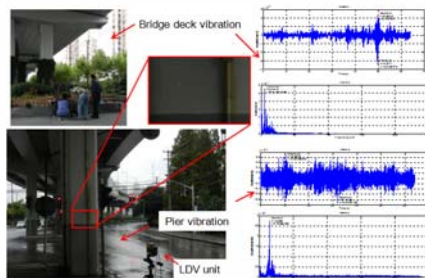


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Laser vibrometer



- Field measurement of a viaduct bridge vibration under traffic loads



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Sensing technology



- 非接触;
- 全局性测量;
- 可重复使用;
- 监测、检测的有效手段。

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Thank you!

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