

## **Invitation to join the 4D-LSM Short Course 2021**

Dear everyone,

If you have some needs for your researches about the numerical methods of DLSSM/4D-LSM, we are pleased to invite you to join the 4D-LSM Short Course 2021 at BJT 09.00-11.00 a.m. on Sundays from May 9 to June 27, 2021. We will introduce the basic principles and usages of DLSSM/4D-LSM and the guidance for user-defined function programming. You can register the short course for free through the following QR code as:



### **ORGANIZERS:**

Commission on DDA, ISRM

Commission on RocDyn, ISRM

Commission on DDA, CSRME

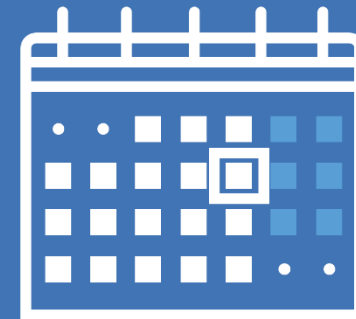
Tianjin University

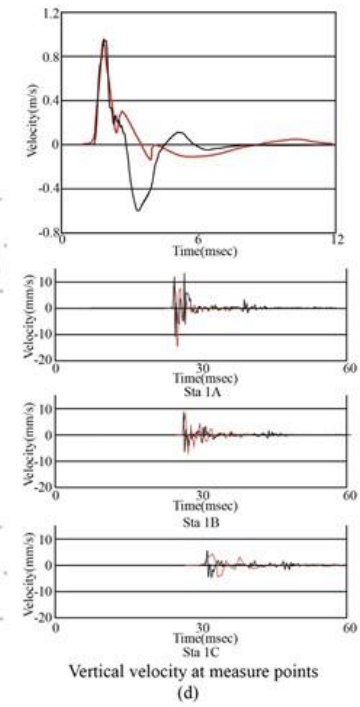
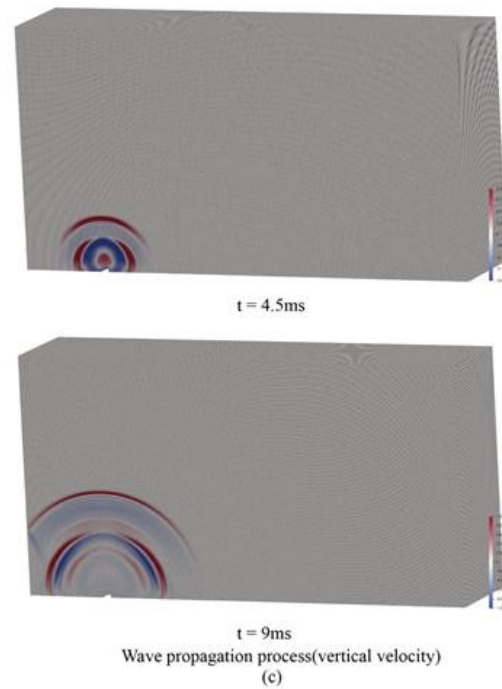
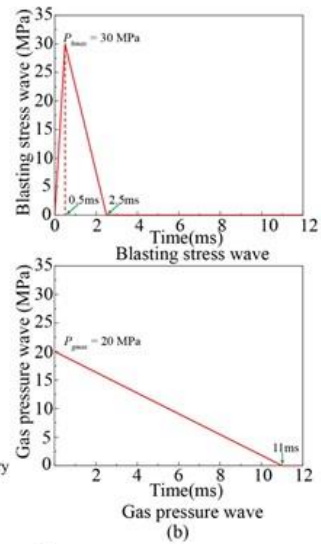
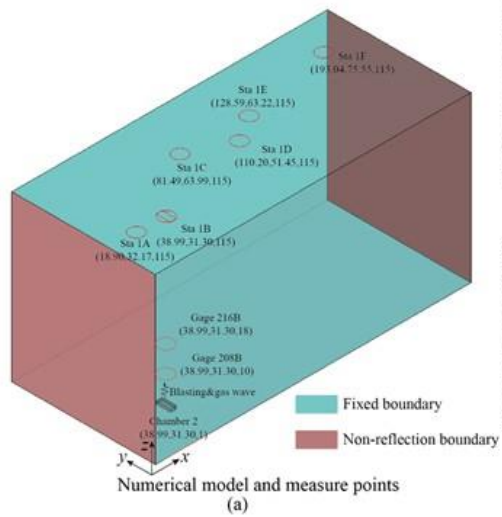
China University of Geosciences (Wuhan)

Hebei University of Technology

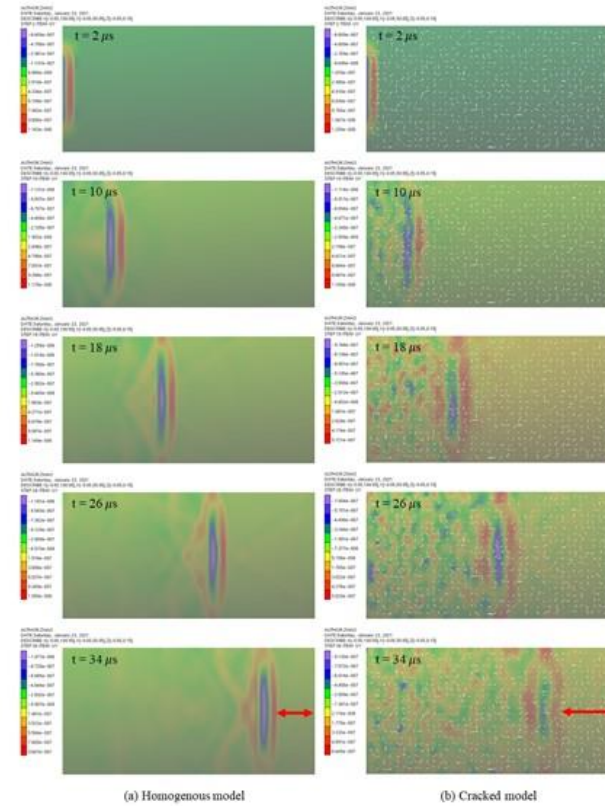
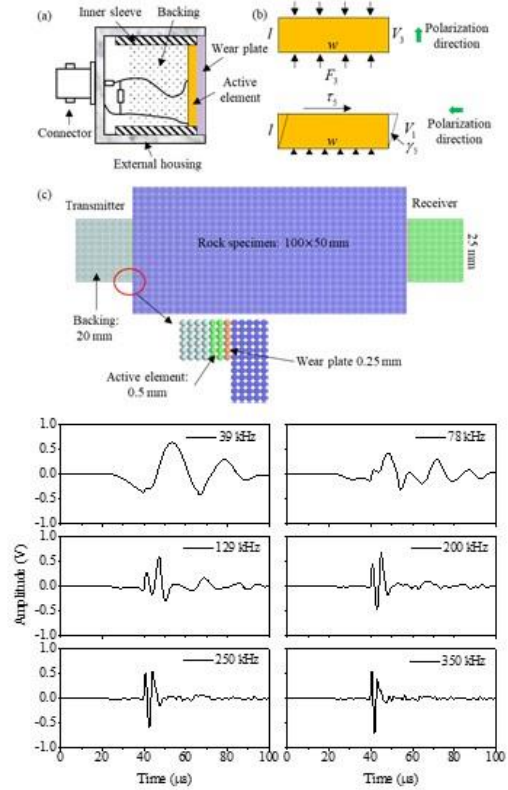
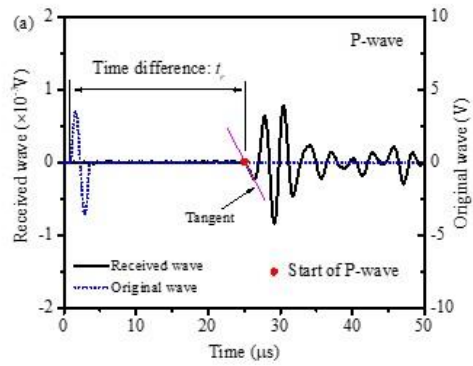
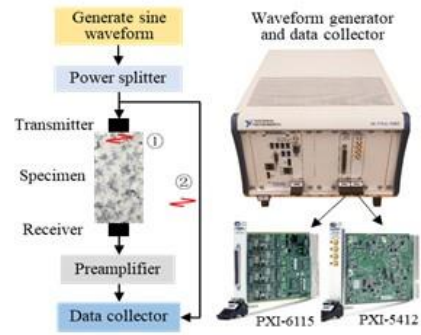
# 4D-LSM Short Course Schedule

1. Introduction	
2021.05.09	BJT 09.00-11.00 a.m.
2. Distinct lattice spring model	
2021.05.16	BJT 09.00-11.00 a.m.
3. Four-dimension lattice spring model	
2021.05.23	BJT 09.00-11.00 a.m.
4. Application: Stress wave propagation	
2021.05.30	BJT 09.00-11.00 a.m.
5. Application: Rock dynamic failure	
2021.06.06	BJT 09.00-11.00 a.m.
6. Application: Engineering excavation	
2021.06.13	BJT 09.00-11.00 a.m.
7. Application: Multi-physical modelling	
2021.06.20	BJT 09.00-11.00 a.m.
8. UDM: User-defined function programming	
2021.06.27	BJT 09.00-11.00 a.m.

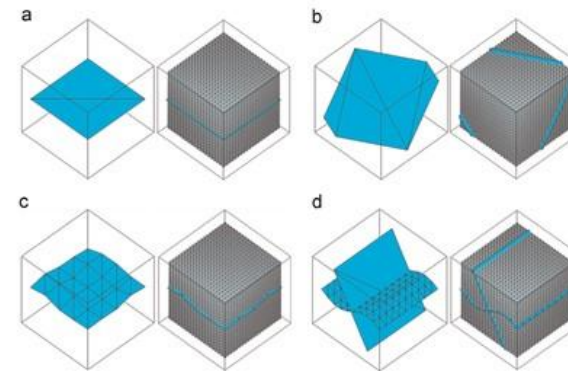
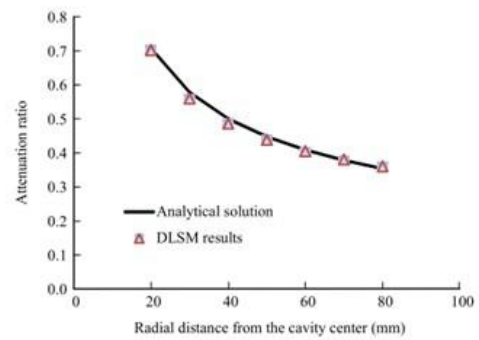
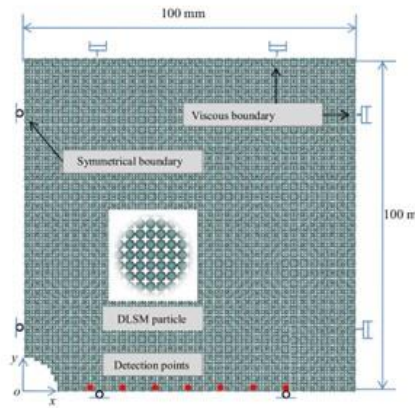
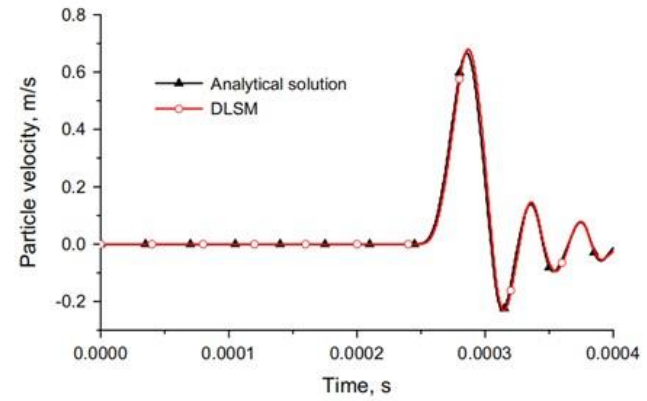
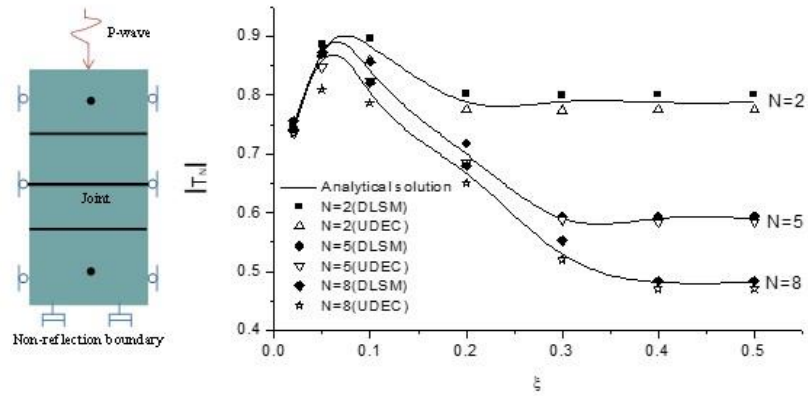




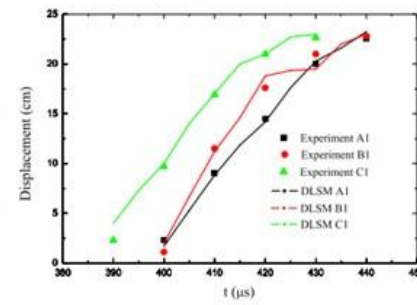
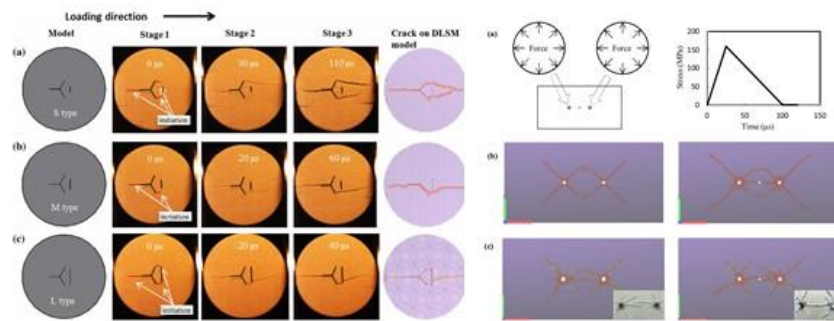
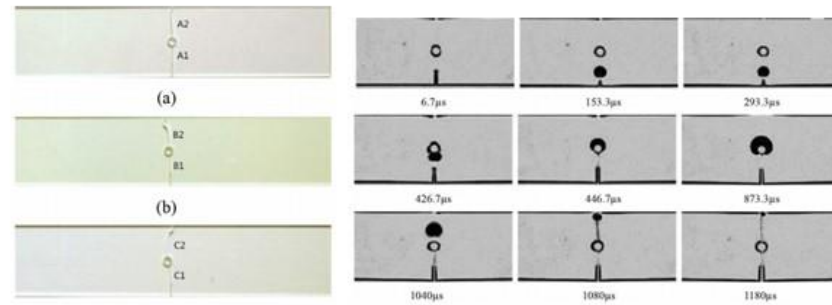
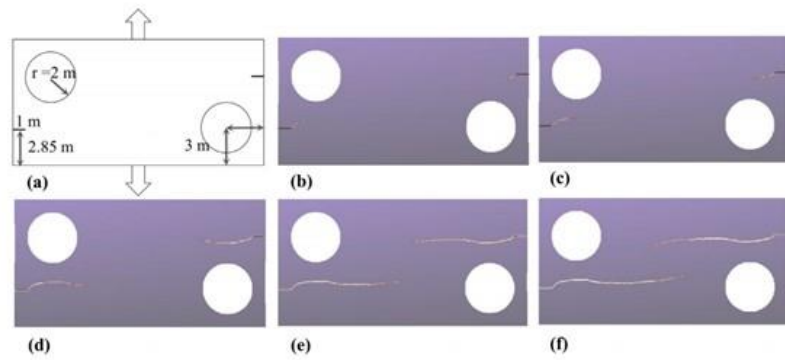
>1 billion elements for full 3D field test on blasting wave propagation



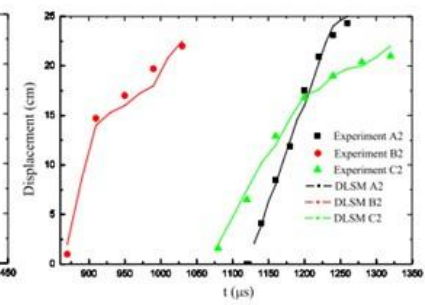
## Acoustic wave propagation



Stress wave propagation in jointed rock



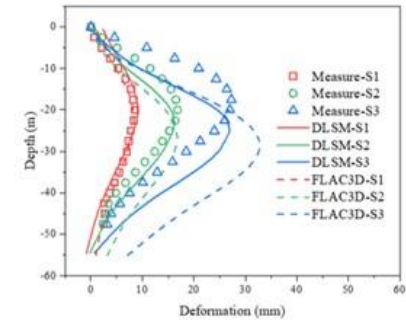
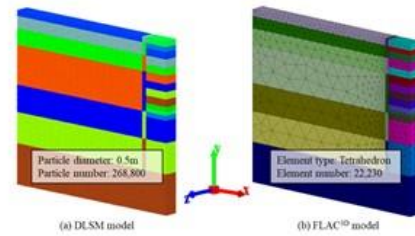
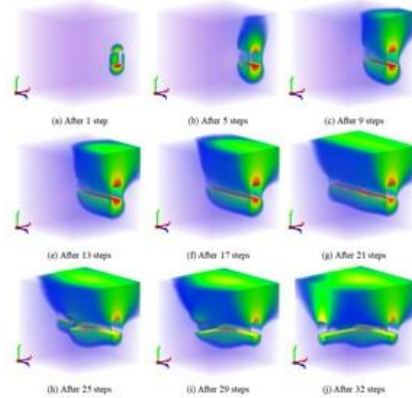
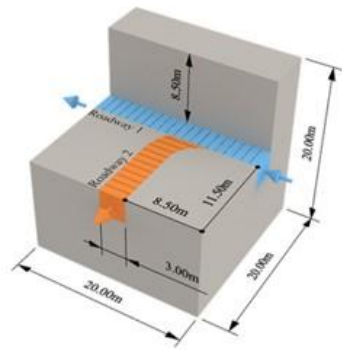
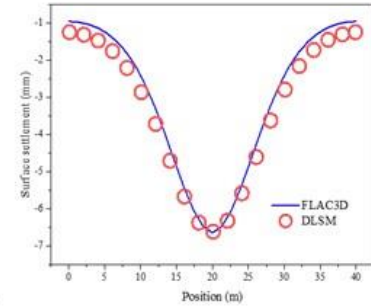
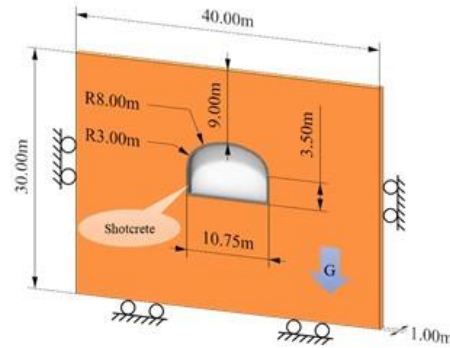
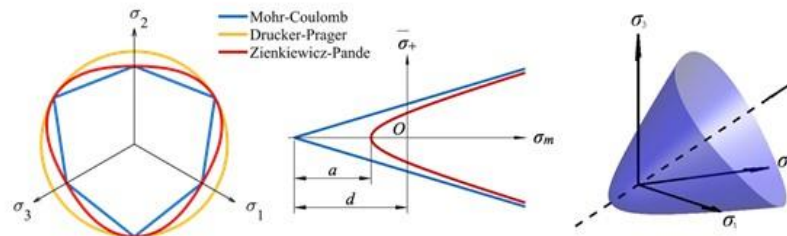
(a) "down cracks"



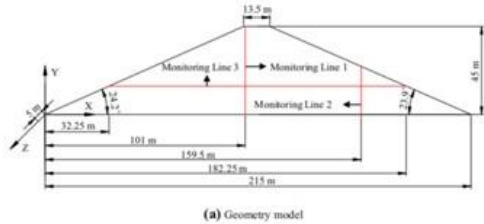
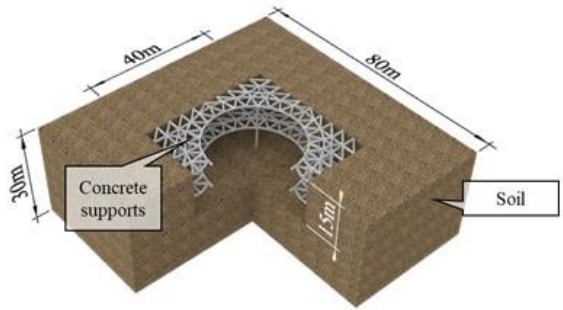
(b) "up cracks"

## Dynamic fracturing of rock

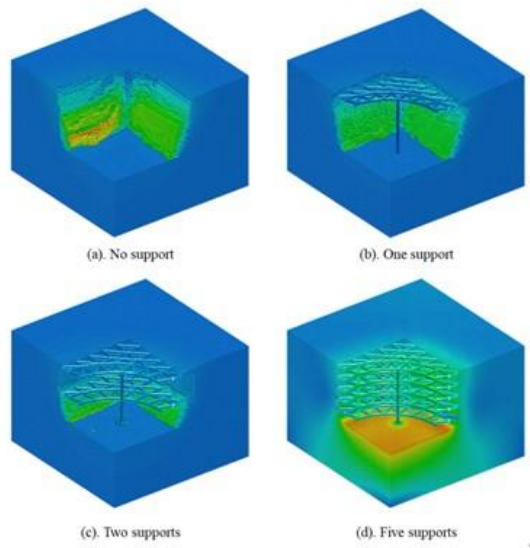




## Excavation & Building



(a) Geometry model

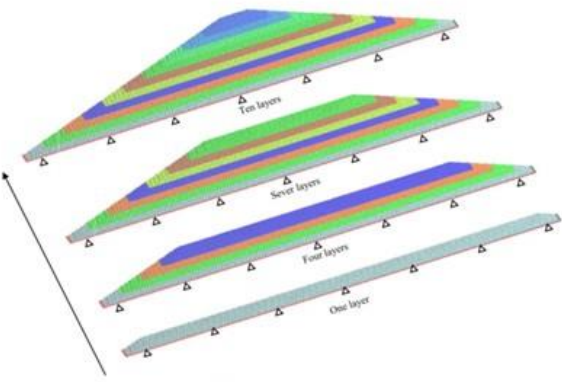


(a). No support

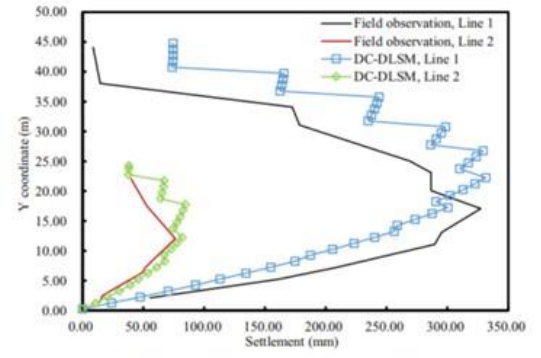
(b). One support

(c). Two supports

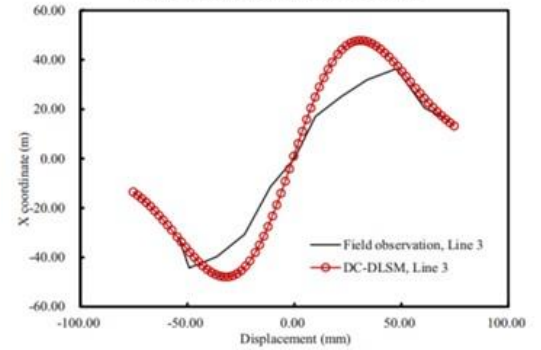
(d). Five supports



(b) Computational model



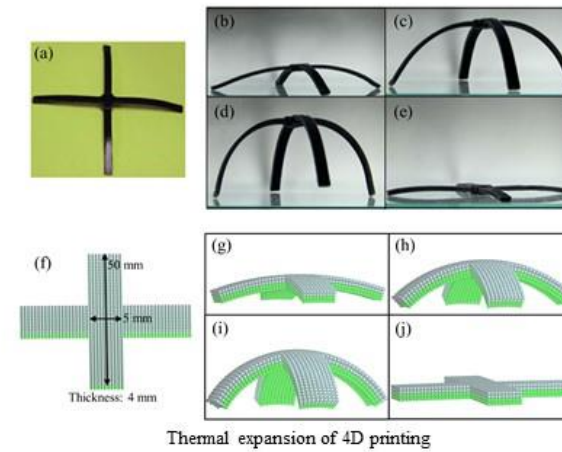
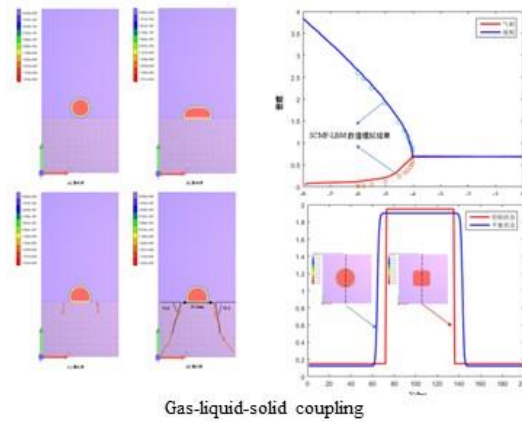
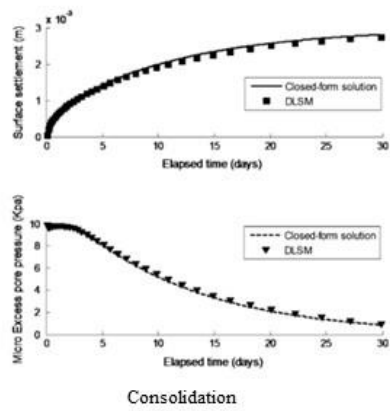
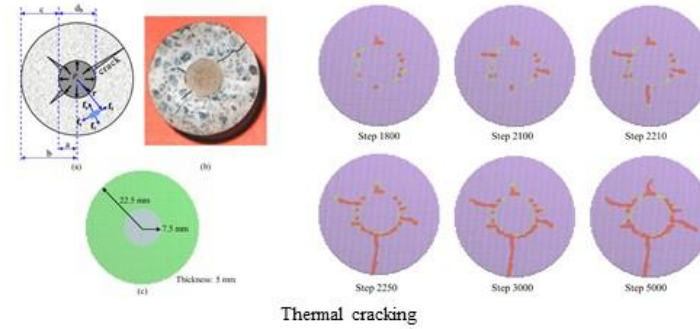
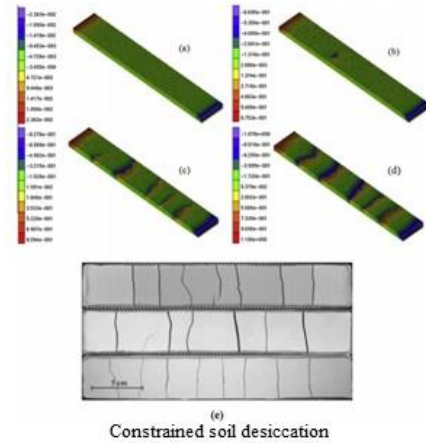
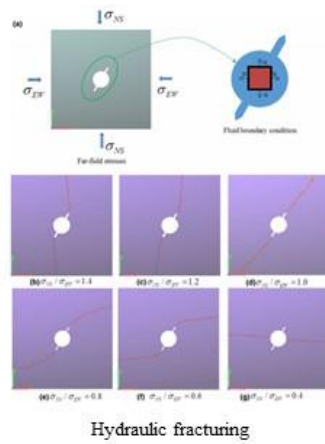
(a) Vertical displacement versus Y coordinate



(b) Horizontal displacement versus X coordinate

## Excavation & Building





## Multi-physics modelling