



○

-

- (FEM : Finite Element Method)
- (FDM : Finite Difference Method)
- (BEM : Boundary Element Method)
- (Discontinuum Model)
- (DEM : Discrete Element Method)
- (Hybrid Method)

○

-

가

•

가

•

가

가

가

-

( - )

•

:

(constitutive equation)

-

•

•

-

•

•

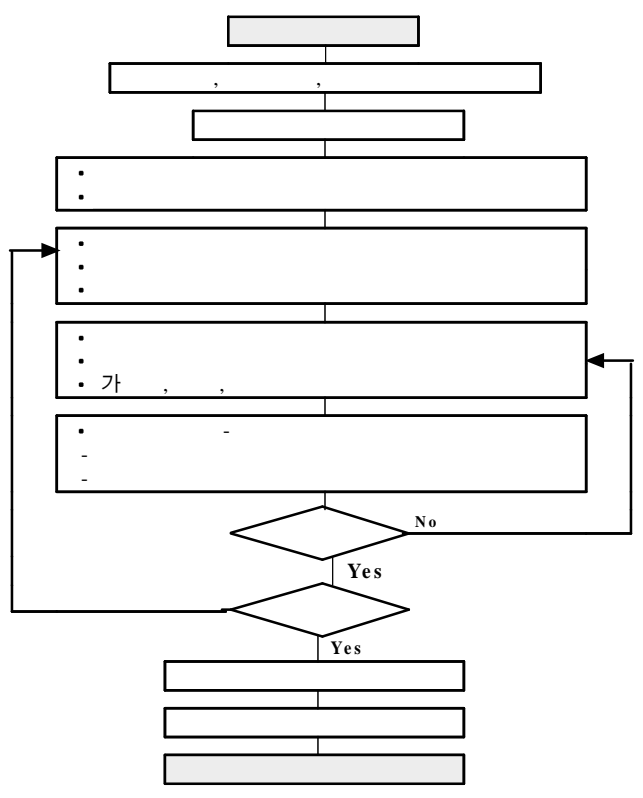
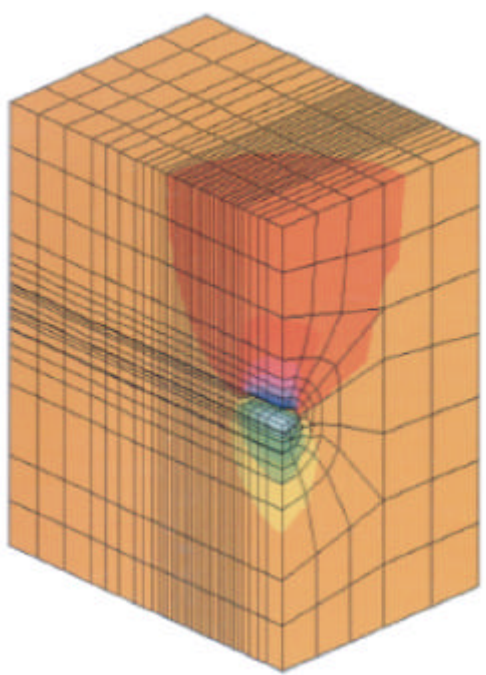
가

-

•

가

• , ,  
 ( ), (E),  
 ( ), ( ), (c), (K<sub>o</sub>)



• 3                    2                    :                    가 3                    3  
 2  
 (Stress Distribution Method),                    (Stiffness Variation Method),  
 (Visco-elastic Analysis)

• : ,  
 • ,  
 • 가  
 • ( )

가

○

가

-

가

가,

,

,

(GPR ),

,

,

가

.

-

,

,

,

,

.

-

,

가

,

.

○

-

•

- :
- : ASSM
- : 5.4m, 6.3m
- : 1984

•

- : , , , , ,
- : , , ,
- : , , ,

-

•

: FLAC(Fast Lagrangian Analysis Continua)

•

: (FDM)

•

: Mohr-Coulomb

•

: (ASSM)

•

( 1 )

•

• X , Y

-

X , Y

•

:  $K_o = 1.0$

•

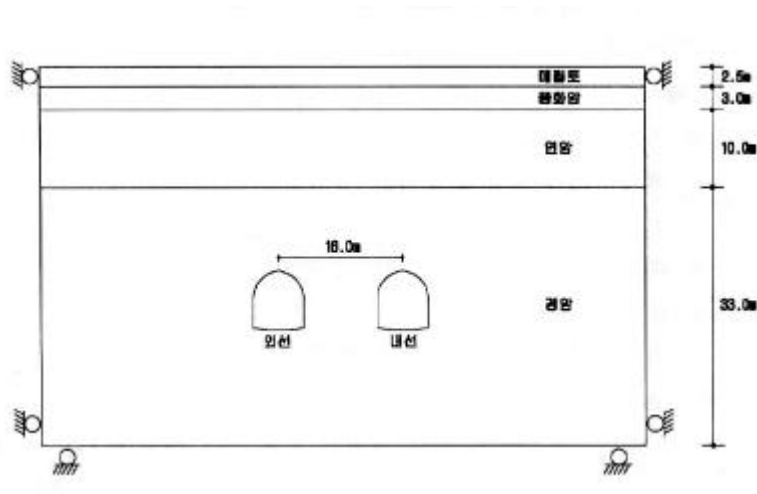
: ( = 3.0m)

-

|   |      |      |     |      | 1      |           |
|---|------|------|-----|------|--------|-----------|
| (t/ m <sup>3</sup> )                    | 1.8  | 2.0  | 2.3 | 2.5  |        | $w = 1.0$ |
| E (x10 <sup>3</sup> t/ m <sup>2</sup> ) | 10   | 30   | 100 | 600  | 1,300  |           |
|   | 0.35 | 0.32 | 0.3 | 0.25 | 0.2    |           |
| c (t/ m <sup>2</sup> )                  | 1    | 10   | 100 | 200  | A=0.25 |           |
| ( ° )                                   | 27   | 32   | 36  | 40   |        |           |

:

.



< 1 >

- (Finite Difference Method)

가

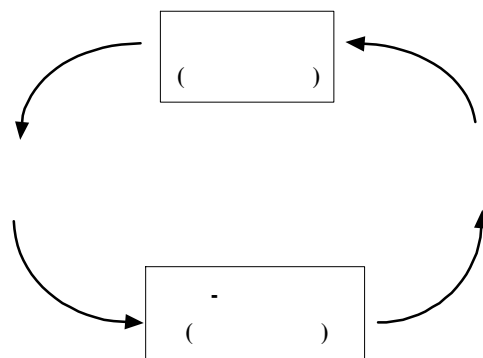
Implicit

Explicit

- Explicit

- Explicit

. ( 2 )



< 2 > Explicit

< >

가  
가

가

< >

3

2

가

FLAC

• (initialization)

•

,

,

,

,

,

가

•

|   |  |                      |         |                          |
|---|--|----------------------|---------|--------------------------|
|   |  |                      |         |                          |
| 1 |  | (t/ m <sup>2</sup> ) | 3.55    | * c <sub>a</sub> = 36.23 |
| 1 |  | (t/ m <sup>2</sup> ) | 96.78   | * c <sub>a</sub> = 840.0 |
|   |  | (mm)                 | 0.73( ) |                          |
|   |  | (mm)                 | 1.66( ) |                          |
|   |  | (mm)                 | 0.74( ) |                          |
|   |  | (mm)                 | 1.67( ) |                          |

• 가 :

○

-

- :  
• : 2

-

- : SAP 90
- : (FEM)
- : SHELL
- 

| CASE   |        |
|--------|--------|
| CASE 1 | • (5m) |
| CASE 2 | • 3.7m |
| CASE 3 | • 2.3m |
| CASE 4 | • 5m   |

•

- ▶ 가 X. Y. Z
- ▶ 가
- ▶ 2

-

- :  $c_k : 210 \text{ kg/cm}^2, E_c = 2.3 \times 10^5 \text{ kg/cm}^2$
- :  $b = 50 \text{ cm}, h = 20 \text{ cm}$
- :  $2.4 \text{ t/m}^2,$

-

- N : 50 가
- : spring

$$K_v = K_{v0} \left( \frac{B_v}{30} \right)^{-\frac{3}{4}} \text{ (kg/cm}^3\text{)}$$



$K_v : 30\text{cm}$   
 $; K_v = 1/30 \times E_o = 46.67 \text{ kg/cm}^3$   
 $: ; = 1.0$   
 $E_o : 28\text{N} = 28 \times 50 = 1,400 \text{ kg/cm}^2$   
 $B_v : ; B_v = 102.5 \text{ cm}$

- Spring ( $k_s$ )  
 $K_s = \cdot K_v$   
 $= 1/5 \times 18.57 \text{ kg/cm}^3 = 3.714 \text{ kg/cm}^3$

$K_s : \text{spring } (\text{kg/cm}^3)$   
 $: \text{spring}$   
 $(\frac{1}{2} \quad \frac{1}{5})$   
 $\frac{1}{5}$

- 가

|      |    |    | $\rho (\text{kg/cm}^2)$ | (mm)  | $M_L (\text{t} \cdot \text{m})$ | $M_r (\text{t} \cdot \text{m})$ |                  |
|------|----|----|-------------------------|-------|---------------------------------|---------------------------------|------------------|
| Case | 51 | 56 | 38.78                   | -3.21 | <b>1.166</b>                    | <b>0.959</b>                    | * $M_a$ $M_{cr}$ |
| Case | 53 | 57 | 12.86                   | -0.95 | 0.388                           | 0.958                           |                  |
| Case | 53 | 56 | 22.3                    | -0.53 | 0.67                            | 0.957                           |                  |
| Case | 52 | 55 | 26.3                    | -3.15 | 0.79                            | 0.958                           |                  |

- 가
  - Case 1 :
  - Case 2, 3, 4 : 가
  - .