Analysis of Potential Surfaces of Multi-Stage Slope based on Local Strength Reduction Method

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2016-12-16

Introduction

Multi-stage slope exists widely in mountainous highway.

Slope stability is an important field in geotechnical engineering.

Fig.1 artificial slope

Fig.2 natural slope

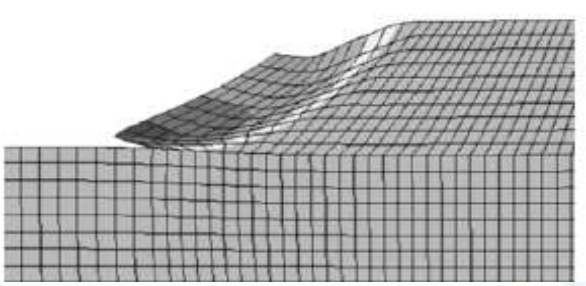
Introduction

Slope stability Method

- **Limit equilibrium method (LEM)**
- **Limit analysis method**
- **Strength reduction method (SRM)**

ZIENKIEWICZ O C etc."Associated and non-associated visco-plasticity and plasticity in soil mechanics, Geotechnique,1975, 25(4): 671–689.

(1) Plastic strain contour of slope



(2) Failure Deformation of slope

Introduction

SRM

- most dangerous sliding surface
- Secondary sliding surface and other sliding surface which do not meet the requirements???

Cala M :modified SRM by FLAC
Yuan W: Local SRM by FLAC (using **point safety factor**)
YAN C: Local SRM by FLAC (using **Logarithmic Spiral**)

Need
programming by user

Local SRM by ABAQUS

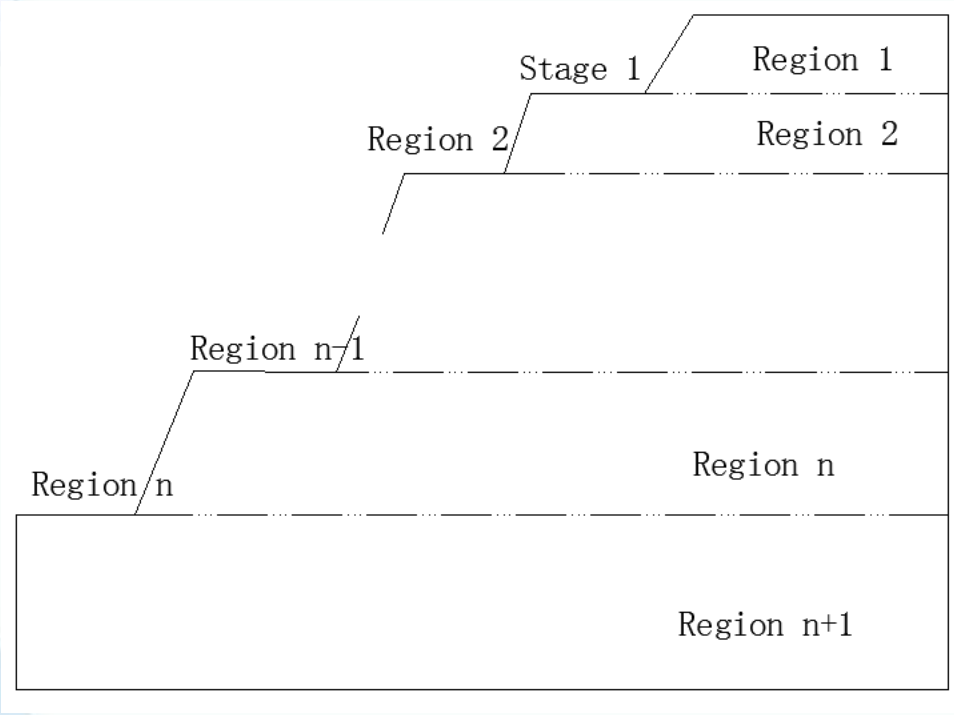


Fig.1 n-stage slope

Steps:

① n-stage slope can be divided into n+1 regions from top to bottom, and all the regions are discretized by finite elements and given the elastic material parameters.

② for the region 1, the material parameters are replaced with the real material parameters and the traditional strength reduction method (SRM) is performed.

③ the plastic elements in the region 1 are replaced with the elastic material parameters, and the region 2 is given the real material parameters. Also the SRM is done on the modified region.

④ Lastly, repeat these steps until region n+1 is analyzed.

Local SRM by ABAQUS

Example A complex slope

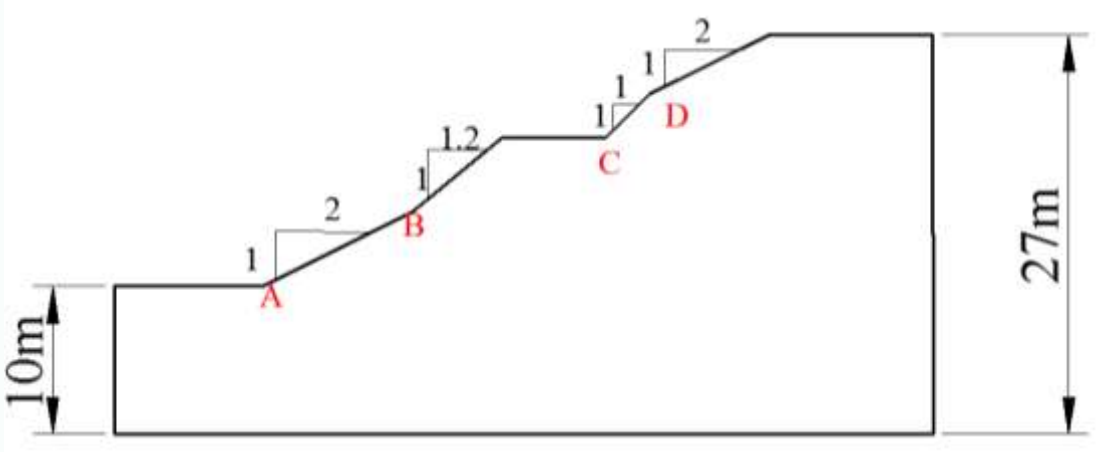
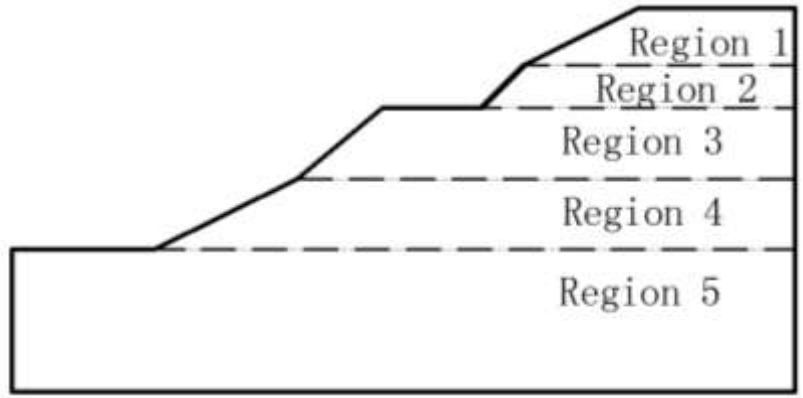


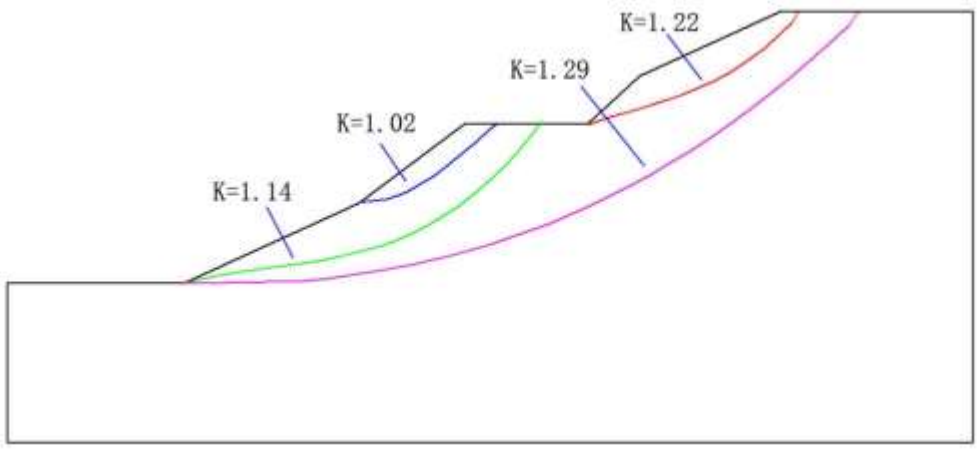
Table 1 Material parameters of complex slope

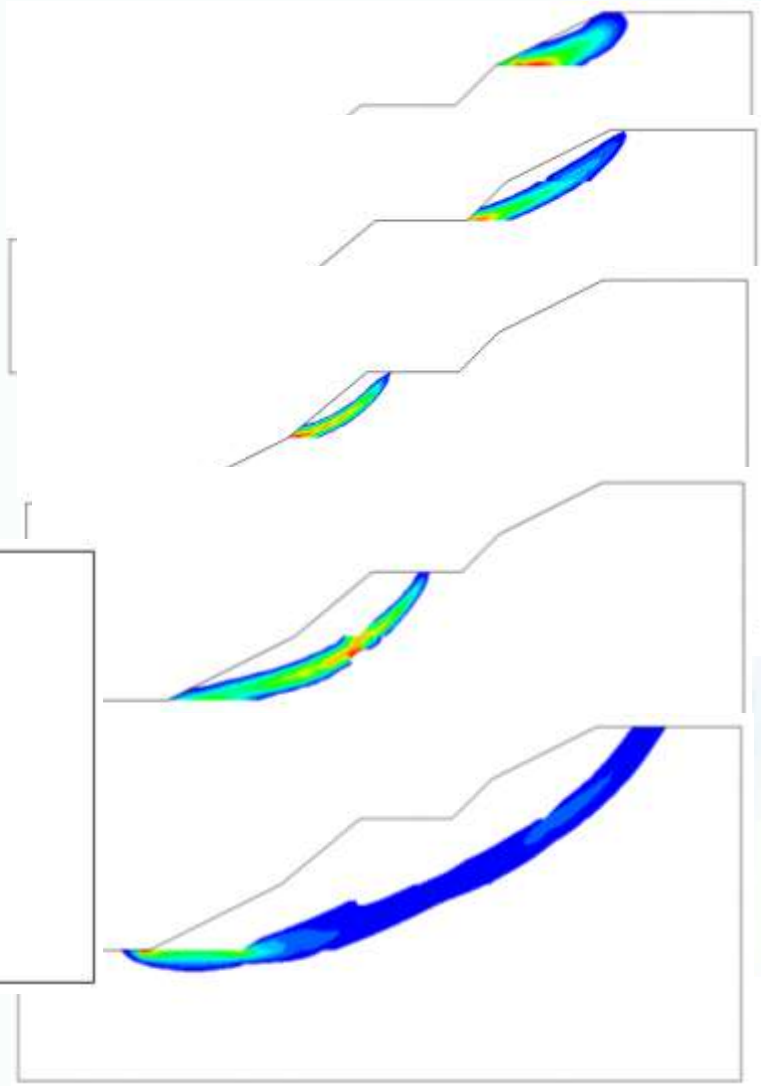
Weight /KN/m^3	Elastic modulus /MPa	poisson ratio	Cohesion /KPa	Frictional angle/°	Dialtion Angle/°
20	14	0.3	4	25	12

Local SRM by ABAQUS

Example A complex slope







Thank You ！