Geomorphology - lab report example

Science, Geography

Geomorphology

Information: Semester: Due GSC336, Lab Report: Driving and Resisting Forces Lab Objective: To gain a deeper understanding of Driving and Resisting Forces, by building a simple model and applying the knowledge acquired in class.

Lab Specific Goals:

a. To learn and apply geomorphology’s unifying concept, driving and resisting forces.

b. To review the various trigonometric functions and constitutive equations

c. To learn how to build equations, simple models and graphical plots in Microsoft Excel.

Lab Requirements:

a. Computer,

b. Microsoft Excel,

c. Hand-held or online calculator,

d. Printer.

Procure

1. The Lab 1 Microsoft Excel worksheet was downloaded from the “ Module 1” in Canvas.

2. The was opened in worksheet in Microsoft Excel.

3. The matrix elements B2, B3, B4, were filled with the corresponding density (ρ), gravitational acceleration (g) and thickness (z).

The following constants were using in during the Lab:

ρ = 1, 000 kg m-3

g = 9. 8 m s-2

z = 1 m

4. The angles values were then entered in column E2: E18, 0-1. 57, in increments of tenths, e. g., 0, 0. 1, 0. 2,… In the last column, (E18), the value 1. 57 was entered instead of 1. 6. These angle values were expressed in radian units.

5. In columns F2: F18, the angles in radians were converted to degrees. A formula was developed in each cell of the Microsoft Excel to do the conversion.

6. Shear Stress was then calculated. In Column G, a constitutive equation that calculates the corresponding shear stress for each angle (degrees) listed in the worksheet was built. Learn

7. Normal Stress was also calculated. In Column H, a constitutive equation that calculates the corresponding normal stress for each angle (degrees) listed in the worksheet was developed. .

8. A scatterplot in was created in Excel. The y, or response axis, is stress (kPa). The x, or Slope angle (deg) and (2) Normal Stress vs. Slope angle (deg). The axes were properly labeled.

9. The matrix and scatter plot were saved as a pdf, and then printed out.

Results and Discussion

The Data Matrix obtained is as shown below:

Slope angle (radians)

Slope angle (Degrees)

Shear stress (acts to impel material downslope)

Normal stress (acts to hold material in place)

F= M sinθ

F= M cos θ

0

0

0

5092. 958179

0

1000

0. 1

5. 729577951

127. 111854

5067. 514602

99. 83342

995. 00417

0. 2

11. 4591559

1011. 814593

4991. 438094

198. 6693

980. 06658

0. 3

17. 18873385

1505. 072054

4865. 488786

295. 5202

955. 33649

0. 4

22. 91831181

1983. 291331

4690. 925123

389. 4183

921. 06099

0. 5

28. 64788976

2441. 694218

4469. 491286

479. 4255

877. 58256

0. 6

34. 37746771

2875. 700503

4203. 39977

564. 6425

825. 33561

0. 7

40. 10704566

3280. 973739

3895. 309273

644. 2177

764. 84219

0. 8

45. 83662361

3653. 46457

3548. 298134

717. 3561

696. 70671

0. 9

51. 56620156

3989. 451191

3165. 833572

783. 3269

621. 60997

1

57. 29577951

4285. 576534

2751. 737048

841. 471

540. 30231

1. 1

63. 02535746

4538. 881814

2310. 146077

891. 2074

453. 59612

1. 2

68. 75493542

4746. 836086

1845. 472889

932. 0391

362. 35775

1. 3

74. 48451337

4907. 361541

1362. 360347

963. 5582

267. 49883

1. 4

80. 21409132

5018. 854262

865. 6355506

985. 4497

169. 96714

1. 5

85. 94366927

5080. 20025

360. 2616098

997. 495

70. 737202

1. 57

89. 95437384

5092. 956564

4. 055658635

999. 9997

0. 7963267

Shear Stress, T= F/A

Normal Stress, N= F/A

F= M sinθ

F= M cos θ

whereby M= 1000

whereby M= 1000

Area (A)= PI() *(B4/2)^2

Area (A)= PI() *(B4/2)^2

T= M sinθ/PI() *(B4/2)^2

T= M sinθ/PI() *(B4/2)^2

Scatter Plot

Helpful definitions:

Matrix - a rectangular array of numbers, symbols, or expressions, arranged in rows and columns. The individual items in a matrix are called its elements or entries.

Radian - standard unit of angular measure, used in many areas of mathematics.

Constitutive equation - a relation between two physical quantities (especially kinetic quantities as related to kinematic quantities) that is specific to a material or substance, and approximates the response of that material to external stimuli, usually as applied fields or forces.

Questions

1. Is shearing force a Driving or Resisting Force? Is normal force a Driving or Resisting force? Which is which? In your own words, justify your answers. (5 pts)

2. In your own words, explain Normal and Resisting Forces using a Boulder on a hillslope as an example. Hint: see you textbook, Chapter 1, for help. (5 pts)

3. Based on your scatter plot and knowledge acquired from your textbook, what is the critical angle, in degrees, that determines if the boulder would move, or not? Why did you choose this angle? (5 pts)

4. A local business informs you they have a 1 m-thick rock slab with a density of 1000 kg m-3 lying in their backyard that slopes at 25 degrees. Given normal weather conditions and unsaturated soils, will this rock slide and potentially destroy their business? Justify your answer in terms of angle, Driving and Resisting forces. (5 pts)

Answer to the Questions

1. Is shearing force a Driving or Resisting Force? Is normal force a Driving or Resisting force? Which is which? In your own words, justify your answers. (5 pts)

Shear force is a driving force because its effect is felt parallel to the slope. Normal force is a resisting force because it effects acts perpendicular to the slope (Lemke).

2. In your own words, explain Normal and Resisting Forces using a Boulder on a hillslope as an example. Hint: see you textbook, Chapter 1, for help. (5 pts)

Normal forces or resting forces on a boulder cliff tends to restrict the movement of an object. The angle of the slope is a contributing factor to the movement of a boulder along a hill slope. Additionally, the stability of the slope also affects the movement of an object. In this case, factors such as friction and cohesion determine how fast an object moves (Lemke).

2. Based on your scatter plot and knowledge acquired from your textbook, what is the critical angle, in degrees, that determines if the boulder would move, or not? Why did you choose this angle? (5 pts)

The critical angle for determining whether the boulder would move, or not is 45. 840 degrees. At this point, the boulder would assume a stationery motion. The value is arrived by observing the point of intersection between the curves of shear and normal stress.

4. A local business informs you they have a 1 m-thick rock slab with a density of 1000 kg m-3 lying in their backyard that slopes at 25 degrees. Given normal weather conditions and unsaturated soils, will this rock slide and potentially destroy their business? Justify your answer in terms of angle, Driving and Resisting forces. (5 pts)

At 25 degrees, the sheer force on the rock will be 984. 807753 while the normal stress will be 173. 6481777 (in the opposite direction). This means that the forces propelling the rock slab downwards are greater than the resisting forces. Assuming that the weather conditions remain at normal levels it is highly likely that the rock in question will inflict a considerable damage to the surrounding property.

Conclusion

The experiment is of great essence. This is because it gives the relationship

between the weights of an object, the forces acting on it, the angle of inclination and the acceleration due to gravity. This concept can be, for instance, used by geomorphologists to establish the effects and extent of flooding on flood plains. Also the concept is applicable in monitoring the changes in river position and patterns, among other geomorphological applications. Work Cited

Lemke, Karen A. “ Slope Stability & Mass Wasting.” University of Wisconsin-Stevens Point, December 1, 2013. Web. January 26, 2015 < http://www4. uwsp. edu/geo/faculty/ lemke/geomorphology/lectures/10_mass_wasting. html>