# COASTAL SEDIMENTATION AND EROSION PROCESS

# PRACTICE 1

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## Problem 1

Decide the following trapezoidal channel under the stable channel criterion.

The stable channel criterion is:

In which, is designed bottom shear stress and is critical shear stress. For the left part of the inequality,

In which, is water density; g is gravitational acceleration; R is hydraulic radius, and is bottom slope; is slope factor, because slope is 1:2, is 0.75.

For the right part of the inequality,

is transversal slope angle, which is,

is angle of repose, for (rounded), .

So,

After we obtain , we can use S0 to calculate shear stress and corresponding , and then we can estimate the turbulent regime and calculate Chezy parameter.

Once we obtain C, we can calculate Q.

Results are shown in the table below

|  |  |
| --- | --- |
|  |  |
|  |  |
|  |  |
|  |  |
| (m3/s) |  |

## Problem 2

Calculate the water depth and sediment transportation in different formulas.

**Answer:**

First, we need to calculate the water depth.

We assume that the water depth h is 1.27m.

because , so

Because k>70, flow is rough regime, so

Then we estimate the bedform and its height and length

Because , bedform is dunes, its shape is

According to the shape and type, we can calculate

For dunes,

Then we calculate the parameter in correct

Because k>70, flow is rough regime, so

according to , we can calculate the and verify if

We can use to estimate the relative error. Use a loop to let traverse from 1 to 1.5 m with an interval of 0.1 m and repeat the above steps to calculate the corresponding . Plot the relationship between error and , and it can be observed that when , the error reaches its minimum value. **Therefore, in the subsequent calculations, we assume the water depth to be 1.27 m.**

图表, 折线图

描述已自动生成

figure 1 The variation of relative error with water depth

Knowing water depth, we can calculate the flow rate Q

We assume that

When it comes to sediment transportation, we first calculate the bed load transportation.

1. Van Rijn complete bed load formula
2. Van Rijn approximation formula
3. Meyer-Peter-Mueller formula
4. Bagnold formula

Then we calculate the suspended load

1. Van Rijn complete
2. Van Rijn approximation
3. Bagnold

Now we have and , we can sum them up and obtain

Besides, we can use Engelund formula to calculate at once

**Summary**

Plot the results obtained from various calculation methods in the following bar chart to facilitate comparison of the results from different formulas.

图表, 条形图

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figure 2 The sediment transport rates calculated using different formulas

**Comment**

As shown in the figure 2, it can be observed that the sediment transport rates calculated using different formulas are of the same order of magnitude, all around . This indicates that although the accuracy of the formulas varies, they still provide relatively consistent results in terms of magnitude.

Furthermore, it was found that the Van Rijn estimation formula gives the highest results for both bed load and suspended load transport, suggesting that this formula may overestimate the transport rate.

Apart from comparing the results of the formulas, under the given conditions, the sediment is primarily transported through suspension, as the suspended load is greater than the bed load.

The code used in this paper can be found in Appendix 1, and it is also available at the following URL: https://github.com/XIANHAOYI/sediment-transportation.git.