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Courses » Computational Hydraulics

Announcements **Course** Forum Progress Mentor

Unit 2 - Week 1

Course outline

How to access the portal

Week 1

- Lecture 1: Introduction to Computational Hydraulics
- Lecture 2: Problem Definition and Governing Equations (GE)
- Lecture 3: Classification of Problems based on Initial Condition (IC) and/or Boundary Conditions (BC)
- Lecture 4: Classification of Differential Equations
- Lecture 5: Numerical Methods : Overview
- Quiz : Week 1: Assignment 1
- Week 1: Lecture Material
- Assignment 1 Solution
- Feedback for week 1

Week 2

- Lecture 6: Finite Difference Approximation
- Lecture 7: Ordinary Differential Equation : IVP
- Lecture 8: Ordinary Differential Equation : BVP
- Lecture 9 Partial Differential Equation : BVP
- Lecture 10: Partial Differential Equation : IBVP
- Week 2: Lecture Material
- Quiz : Week 2: Assignment
- Feedback for week 2
- Assignment-2 Solution

Week 3

- Lecture 11: Partial Differential Equation : Numerical Stability of IBVP
- Lecture 12: Partial Differential Equation : Numerical Stability of One Dimensional PDE
- Lecture 13: Finite Volume Method - Overview
- Lecture 14: Finite Volume Method - BVP
- Lecture 15: Finite Volume Method - IBVP
- Quiz : Week 3 Assignment
- Week 3: Lecture material
- Feedback for week 3

Week 1: Assignment 1

The due date for submitting this assignment has passed.

Due on 2017-08-15, 23:59 IST.

Submitted assignment

1) In mesh-free methods, domain is discretized using *1 point*

- Rectangular Grids
- Triangular Mesh
- Points

No, the answer is incorrect.
Score: 0

Accepted Answers:
Points

2) In well-posed problems, *1 point*

- Solution of the problem exists.
- Solution is unique
- Solution does not depend on data and parameters.

No, the answer is incorrect.
Score: 0

Accepted Answers:
Solution of the problem exists.
Solution is unique

3) Numerical discretization with finite difference method and finite volume method is based on *1 point*

- Eulerian-Lagrangian approach
- Lagrangian approach
- Eulerian approach

No, the answer is incorrect.
Score: 0

Accepted Answers:
Eulerian approach

4) Let us consider a large diameter well with casing is tapping water from homogeneous isotropic artesian aquifer of uniform thickness as shown in following figure *1 point*

Assignment 3 Solution

Week 4

Lecture 16: Finite Volume Method - Conservation Law

Lecture 17: Upwind Approach

Lecture 18: Godunov Approach

Lecture 19:

Lecture 20

Quiz : Week 4 Assignment

Lecture Material

Feedback for week 4

Assignment 4 Solution

Week 5

Lecture 21: Mesh-Tree Method : Plynomial Interpolation Method

Lecture 22: Mesh -Free Method : Moving Least Squares Method

Lecture 23: Mesh-Free Method : Space-Time Moving Least Squares Method

Lecture 24: Numerical Method : Matrix Structure and Scilab

Lecture 25: Algebraic Equation:Gauss Elimination Method

Quiz : Week 5 Assignment

Lecture Material

Scilab Code

Feedback for week 5

Assignment 5 Solution

Week 6

Lecture 26: Algebraic Equation: LU Decomposition Method

Lecture 27: Algebraic Equation : Tri Diagonal Matrix Method

Lecture 28: Algebraic Equation : Jacobis Method

Lecture 29: Algebraic Equation : Gauss - Seidel Method

Lecture 30: Algebraic Equation : Newton Raphson Method

Lecture Material

Scilab Codes

Quiz : Week 6 Assignment

Assignment 6 Solution

Week 7

Lecture 31

Lecture 32

Lecture 33

Quiz : Week 7 Assignment

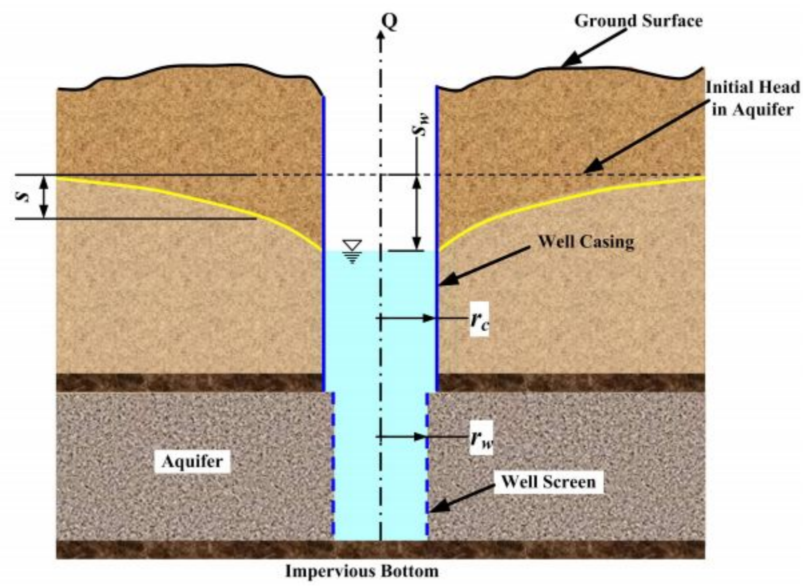
Lecture Material

Scilab Codes

Lecture Material

Assignment Solution 7

Week 8



The governing equation for radial groundwater flow can be written as,

$\frac{S}{T}\frac{\partial s}{\partial t} = \frac{\partial^2 s}{\partial r^2} + \frac{1}{r}\frac{\partial s}{\partial r}, r \geq r_w$

subject to the conditions,

Drawdown in the aquifer at the face of the well is equal to that of the well.

$s(r_w, t) = s_w(t)$

Drawdown is zero at an infinite distance from the well.

$s(\infty, t) = 0$

Drawdown everywhere in the aquifer and in the well are initially zero.

$s(r, 0) = 0, r \geq r_w$

$s_w(0) = 0$

The rate of the discharge of the well is equal to the sum of the rate of flow of water into the well and the rate of decrease in volume of water within the well.

$2\pi r_w T\frac{\partial s(r_w,t)}{\partial r} - \pi r_c^2\frac{\partial s_w}{\partial t} = -Q, t > 0$

where

s= drawdown in the aquifer at distance *r* and time *t*, s_w= drawdown in the well at time t, *r*= distance from the centre of well, r_w =effective radius of well screen or open hole, r_c =radius of well casing in the interval over which the water level declines, *t*= time since well begins to discharge, *S*= coefficient of storage of aquifer, *T*= transmissivity of aquifer, *Q*= constant discharge of well.

The equation can be classified as

- Partial Differential Equation
- Ordinary Differential Equation
- None of the above

No, the answer is incorrect.
Score: 0

Accepted Answers:
Partial Differential Equation

5) Supporting conditions for the governing equation (groundwater) are *1 point*

- Initial condition
- Boundary conditions
- Initial and boundary conditions

No, the answer is incorrect.
Score: 0

Accepted Answers:
Initial and boundary conditions

6) The problem (groundwater) can be classified as *1 point*

- Initial value problem
- Initial boundary value problem
- boundary value problem

No, the answer is incorrect.
Score: 0

Accepted Answers:
Initial boundary value problem

7) The problem (groundwater) can be classified as *1 point*

- Lecture 34
- Lecture 35
- Lecture 36
- Scilab Codes
- Lecture Material
- Quiz : Assignment 8
- Assignment 8 Solution

Week 9

- Lecture 37
- Lecture 38
- Lecture 39
- Scilab Codes
- Lecture Material
- Quiz : Assignment 9
- Assignment 9: Solution

Week 10

- Lecture 40 : Steady Channel Flow : Channel Network without Reverse Flow
- Lecture 41 : Steady Channel Flow : Channel Network without Reverse Flow (Contd.)
- Lecture 42 : Steady Channel Flow : Channel Network with Reverse Flow
- Lecture 43 : Steady Channel Flow : Channel Network with Reverse Flow (Contd.)
- Scilab Codes
- Lecture Material
- Quiz : Assignment 10
- Assignment Solution

Week 11

- Lecture 44: Unsteady 1D Channel Flow
- Lecture 45 : Unsteady 1D Channel Flow (Contd.)
- Lecture 46 : Unsteady 2D Surface Flow
- Lecture 47 : Steady Flow in Pipe Network
- Lecture 48 : Steady Flow in Pipe Network (Contd.)
- Quiz : Assignment 11
- Lecture Material
- Scilab Codes
- Assignment Solution 11

Week 12

- Lecture 49 : Unsteady Flow in Pipes
- Lecture 50 : Surface Water and Ground Water Interaction
- Lecture 51 : Course Summary
- Quiz : Assignment 12
- Assignment 12 Solution

Jury problem

Time-marching problem

No, the answer is incorrect.
Score: 0

Accepted Answers:
Time-marching problem

8) Motion of saltating particle is governed by force due to its submerged weight (F_G) and hydrodynamic forces, which can be solved into a lift force (F_L), a drag force (F_D) as shown in the following Figure ***1 point***

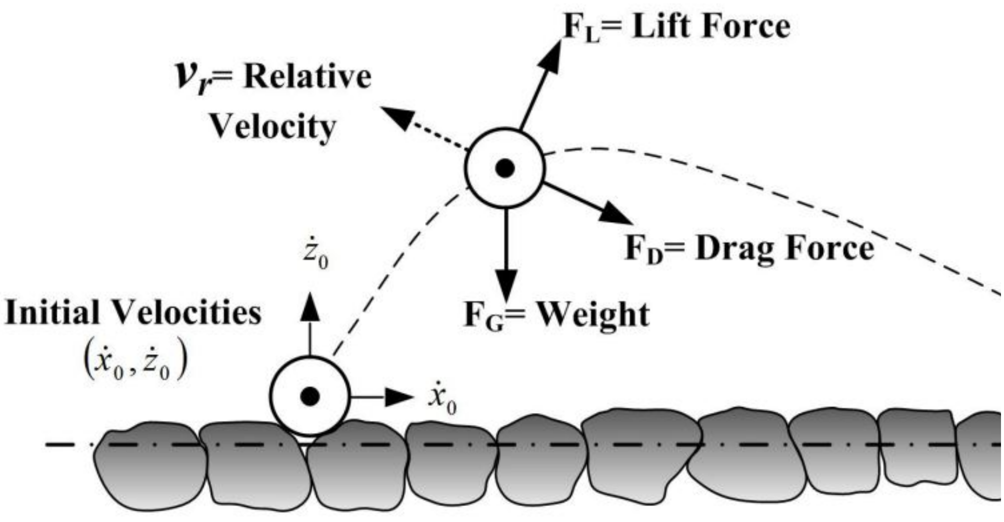


Figure 1: Definition Sketch of Particle Saltation (van

Equations of motion for saltating particles can be expressed as,

$m\ddot{x} - \frac{F_L}{v_r}\dot{x} - \frac{F_D}{v_r}\left(u - \dot{z}\right) = 0$

$m\ddot{z} - \frac{F_L}{v_r}\left(u - \dot{x}\right) + \frac{F_D}{v_r}\dot{z} + F_G = 0$

subject to the conditions,

$x(t=0) = x_0 z(t=0) = z_0 \dot{x}(t=0) = \dot{x}_0 \dot{z}(t=0) = \dot{z}_0$

where, *m*= particle mass and added fluid mass, *A*= particle area, *u*= local flow velocity, F_D= drag force, F_L= lift force, F_G= gravity force, relative particle velocity $v_r = [(u-\dot{x})^2 + \dot{z}^2]^{0.5}$.

The problem can be simplified by considering,

$y_1 = x$

$y_2 = z$

$y_3 = \dot{x}$

$y_4 = \dot{z}$

$\dot{y_1} = y_3$

$\dot{y_2} = y_4$

$\dot{y_3} = \frac{1}{m}\left[\frac{F_L}{v_r}y_3 + \frac{F_D}{v_r}\left(u - y_4\right)\right]$

$\dot{y_4} = \frac{1}{m}\left[\frac{F_L}{v_r}\left(u - y_3\right) - \frac{F_D}{v_r}y_4 - F_G\right]$

subject to conditions,

$y_1(t=0) = x_0$

$y_2(t=0) = z_0$

$y_3(t=0) = \dot{x}_0$

$y_4(t=0) = \dot{z}_0$

The equations (saltation) are

Partial Differential Equations

Ordinary Differential Equations

No, the answer is incorrect.
Score: 0

Accepted Answers:
Ordinary Differential Equations

9) Supporting conditions for the governing equations (saltation) are ***1 point***

Boundary Conditions

Initial and Boundary Conditions

Initial Conditions

No, the answer is incorrect.
Score: 0

Accepted Answers:

Initial Conditions

10) The problem (saltation) can be classified as **1 point**

- Initial Boundary Value Problem
- Initial Value Problem
- Boundary Value Problem

No, the answer is incorrect.
Score: 0

Accepted Answers:
Initial Value Problem

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