iemisc: Manning... Examples using iemiscdata

Irucka Embry, E.I.T. (EcoC²S)

2024-06-05

Contents

The following examples are for solving for missing variables in circular, trapezoidal, triangular, and rectangular cross-sections using the Gauckler-Manning-Strickler Equation.

Manningcirc and Manningcircy Examples

```r
# Practice Problem 14.12 from Mott (page 392)

#'
install.load::load_package("iemisc", "iemiscdata")
#'
y <- Manningcircy(y_d = 0.5, d = 6, units = "Eng")
#'
# See npartfull in iemiscdata for the Manning's n table that the following
# example uses Use the normal Manning's n value for 1) Corrugated Metal, 2)
# Stormdrain.
#'
data(npartfull)
#'
# We are using the culvert as a stormdrain in this problem
nlocation <- grep("Stormdrain", npartfull$"Type of Conduit and Description")
#'
n <- as.numeric(npartfull[nlocation, 3])  # 3 for column 3 - Normal n
#'
Manningcirc(d = 6, Sf = 1/500, n = n, y = y$y, units = "Eng")
```

```
##
## Flow IS in the rough turbulent zone so the Gauckler-Manning-Strickler equation
##  is acceptable to use.
##
##
## This is subcritical flow.
```

```
## $Q
## [1] 51.29267
##
## $V
## [1] 3.628214
##
## $A
## [1] 14.13717
##
## $P
## [1] 9.424778
##
## $R
## [1] 1.5
##
## $Re
## [1] 503630.1
##
## $Fr
## [1] 0.416711
```

```
# d = 6 ft, Sf = 1 / 500 ft/ft, n = 0.024, y = 3 ft, units = 'Eng' This will
# solve for Q since it is missing and Q will be in ft^3/s
#'
#'
#'
# Example Problem 14.2 from Mott (pages 377-378)
#'
install.load::load_package("iemisc", "iemiscdata")
#'
y <- Manningcircy(y_d = 0.5, d = 200/1000, units = "SI")
#'
# See npartfull in iemiscdata for the Manning's n table that the following
# example uses Use the normal Manning's n value for 1) Clay, 2) Common drainage
# tile.
#'
data(npartfull)
#'
nlocation <- grep("Common drainage tile", npartfull$"Type of Conduit and Description")
#'
n <- as.numeric(npartfull[nlocation, 3])  # 3 for column 3 - Normal n
#'
Manningcirc(Sf = 1/1000, n = n, y = y$y, d = 200/1000, units = "SI")
```

```
##
## Flow IS in the rough turbulent zone so the Gauckler-Manning-Strickler equation
##  is acceptable to use.
##
```

```
##
## This is subcritical flow.
## $Q
## [1] 0.005185889
##
## $V
## [1] 0.3301439
##
## $A
## [1] 0.01570796
##
## $P
## [1] 0.3141593
##
## $R
## [1] 0.05
##
## $Re
## [1] 16442.62
##
## $Fr
## [1] 0.376182
```

```
# Sf = 1/1000 m/m, n = 0.013, y = 0.1 m, d = 200/1000 m, units = SI units This
# will solve for Q since it is missing and Q will be in m^3/s
#'
#'
#'
# Example 4.1 from Sturm (pages 124-125)
#'
install.load::load_package("iemisc", "iemiscdata")
#'
Manningcircy(y_d = 0.8, d = 2, units = "Eng")
```

```
## $theta
## [1] 4.428595
##
## $y
## [1] 1.6
##
## $A
## [1] 2.694297
##
## $P
## [1] 4.428595
##
## $B
## [1] 1.6
##
## $R
## [1] 0.6083865
```

```
#'
y <- Manningcircy(y_d = 0.8, d = 2, units = "Eng")
# defines all list values within the object named y
```

```r
#'
y$y  # gives the value of y
```

```
## [1] 1.6
```

```r
#'
#'
#'
# Modified Exercise 4.1 from Sturm (page 153)
#'
install.load::load_package("iemisc", "iemiscdata")
#'
# Note: The Q in Exercise 4.1 is actually found using the Chezy equation, this
# is a modification of that problem See nchannel in iemiscdata for the
# Manning's n table that the following example uses Use the normal Manning's n
# value for 1) Natural streams - minor streams (top width at floodstage < 100
# ft), 2) Mountain streams, no vegetation in channel, banks usually steep,
# trees and brush along banks submerged at high stages and 3) bottom: gravels,
# cobbles, and few boulders.
#'
data(nchannel)
#'
nlocation <- grep("bottom: gravels, cobbles, and few boulders", nchannel$"Type of Channel and Descripti
#'
n <- as.numeric(nchannel[nlocation, 3])  # 3 for column 3 - Normal n
#'
Manningcirc(Sf = 0.002, n = n, y = y$y, d = 2, units = "Eng")
```

```
##
## Flow IS in the rough turbulent zone so the Gauckler-Manning-Strickler equation
##  is acceptable to use.
##
##
## This is subcritical flow.
```

```
## $Q
## [1] 3.213774
##
## $V
## [1] 1.192806
##
## $A
## [1] 2.694297
##
## $P
## [1] 4.428595
##
## $R
## [1] 0.6083865
##
## $Re
## [1] 67154.76
##
## $Fr
## [1] 0.1620521
```

```r
# Sf = 0.002 ft/ft, n = 0.04, y = 1.6 ft, d = 2 ft, units = English units This
# will solve for Q since it is missing and Q will be in ft^3/s
#'
#'
#'
# Modified Exercise 4.5 from Sturm (page 154)
#'
install.load::load_package("iemisc", "units")
#'
#'
# create a numeric vector with the units of feet
yeng <- set_units(y$y, ft)


# create a numeric vector to convert from feet to meters
ysi <- yeng


# create a numeric vector with the units of meters
units(ysi) <- make_units(m)


# create a numeric vector with the units of feet
deng <- set_units(2, ft)


# create a numeric vector to convert from feet to meters
dsi <- deng


# create a numeric vector with the units of meters
units(dsi) <- make_units(m)
#'
Manningcirc(Sf = 0.022, n = 0.023, y = drop_units(ysi), d = drop_units(dsi), units = "SI")
```

```
##
## Flow IS in the rough turbulent zone so the Gauckler-Manning-Strickler equation
##  is acceptable to use.
##
##
## This is subcritical flow.
## $Q
## [1] 0.5249146
##
## $V
## [1] 2.097071
##
## $A
## [1] 0.2503084
##
## $P
## [1] 1.349836
##
```

```
## $R
## [1] 0.1854362
##
## $Re
## [1] 387351.6
##
## $Fr
## [1] 0.9347223
```

```
# Sf = 0.022 m/m, n = 0.023, y = 0.48768 m, d = 0.6096 m, units = SI units This
# will solve for Q since it is missing and Q will be in m^3/s
#'
#'
```

Manningtrap Examples

```
#'
install.load::load_package("iemisc", "iemiscdata")
#'
# Practice Problem 14.19 from Mott (page 392) See nchannel in iemiscdata for
# the Manning's n table that the following example uses Use the minimum
# Manning's n value for 1) Natural streams - minor streams (top width at
# floodstage < 100 ft) Lined or Constructed Channels, 3) Concrete and 4) float
# finish.
#'
data(nchannel)
#'
nlocation <- grep("float finish", nchannel$"Type of Channel and Description")
#'
n <- as.numeric(nchannel[nlocation, 3][1])  # 3 for column 3 - Normal n
#'
tt <- Manningtrap(y = 1.5, b = 3, m = 3/2, Sf = 0.1/100, n = n, units = "SI", type = "symmetrical",
    output = "list")
```

```
##
## Flow IS in the rough turbulent zone so the Gauckler-Manning-Strickler equation
##  is acceptable to use.
##
##
## This is subcritical flow.
```

```
# y = 1.5 m, b = 3 m, m = 3/2, Sf = 0.1/100 m/m, n = 0.023, units = SI units
# This will solve for Q since it is missing and Q will be in m^3/s
#'
tt$Q  # only returns Q
```

```
## [1] 15.8923
```

```
#'
tt  # returns all results
```

```
## $Q
```

```
## [1] 15.8923
##
## $V
## [1] 2.018069
##
## $y
## [1] 1.5
##
## $b
## [1] 3
##
## $m
## [1] 1.5
##
## $Sf
## [1] 0.001
##
## $n
## [1] 0.015
##
## $A
## [1] 7.875
##
## $P
## [1] 8.408327
##
## $R
## [1] 0.9365716
##
## $B
## [1] 7.5
##
## $D
## [1] 1.05
##
## $w
## [1] 2.704163
##
## $Z
## [1] 7.538377
##
## $E
## [1] 1.707645
##
## $K
## [1] 502.5585
##
## $Vel_Head
## [1] 0.207645
##
## $Re
## [1] 1882672
##
## $Fr
```

```
## [1] 0.6288992
##
## $taud
## [1] 0.01468288
##
## $tau0
## [1] 0.009167712
#'
#'
```

Manningtrap_critical Examples

```
install.load::load_package("iemisc", "iemiscdata")
#'
# Practice Problem 14.19 from Mott (page 392) See nchannel in iemiscdata for
# the Manning's n table that the following example uses Use the minimum
# Manning's n value for 1) Natural streams - minor streams (top width at
# floodstage < 100 ft) Lined or Constructed Channels, 3) Concrete and 4) float
# finish.
#'
data(nchannel)
#'
nlocationc <- grep("float finish", nchannel$"Type of Channel and Description")
#'
nc <- as.numeric(nchannel[nlocationc, 3][1])  # 3 for column 3 - Normal n
#'
ttc <- Manningtrap_critical(y = 1.5, b = 3, m = 3/2, Sf = 0.1/100, n = nc, units = "SI",
    type = "symmetrical", critical = "accurate", output = "list")

##
## Flow IS in the rough turbulent zone so the Gauckler-Manning-Strickler equation
##  is acceptable to use.
##
##
## This is subcritical flow.

# y = 1.5 m, b = 3 m, m = 3/2, Sf = 0.1/100 m/m, n = 0.023, units = SI units
# This will solve for Q since it is missing and Q will be in m^3/s
#'
ttc$Q  # only returns Q

## [1] 15.892

#'
ttc  # returns all results

## $Q
## [1] 15.892
##
## $V
## [1] 2.018
```

```
##
## $y
## [1] 1.5
##
## $b
## [1] 3
##
## $m
## [1] 1.5
##
## $Sf
## [1] 0.001
##
## $n
## [1] 0.015
##
## $A
## [1] 7.875
##
## $P
## [1] 8.408
##
## $R
## [1] 0.937
##
## $B
## [1] 7.5
##
## $D
## [1] 1.05
##
## $w
## [1] 2.704
##
## $Z
## [1] 7.538
##
## $E
## [1] 1.708
##
## $K
## [1] 502.558
##
## $Vel_Head
## [1] 0.208
##
## $Re
## [1] 1882672
##
## $Fr
## [1] 0.629
##
## $taud
## [1] 0.015
```

```
##
## $tau0
## [1] 0.009
##
## $yc
## [1] 1.419
##
## $Ac
## [1] 7.281
##
## $Pc
## [1] 8.118
##
## $Bc
## [1] 7.258
##
## $Rc
## [1] 0.897
##
## $Dc
## [1] 1.003
##
## $Vc
## [1] 3.731
##
## $Qc
## [1] 25.27
##
## $Sfc
## [1] 0.00122
##
## $Frc
## [1] 1
##
## $Zc
## [1] 8.069
##
## $Ec
## [1] 1.662
#'
#'
```

Manningtri Examples

```
install.load::load_package("iemisc", "iemiscdata")
#'
# Practice Problem 14.41 from Mott (page 393) See nchannel in iemiscdata for
# the Manning's n table that the following example uses Use the normal
# Manning's n value for 1) Natural streams - minor streams (top width at
```

```r
# floodstage < 100 ft), 2) Excavated or Dredged Channels, 3) Earth, straight,
# and uniform, 4) clean, recently completed.
#'
data(nchannel)
#'
nlocation <- grep("clean, recently completed", nchannel$"Type of Channel and Description")
#'
n <- as.numeric(nchannel[nlocation, 3])  # 3 for column 3 - Normal n
#'
Manningtri(Q = 0.68, m = 1.5, Sf = 0.0023, n = n, units = "Eng")
```

```
##
## Flow IS in the rough turbulent zone so the Gauckler-Manning-Strickler equation
##  is acceptable to use.
##
##
## This is subcritical flow.
```

```
## $y
## [1] 0.5524423
##
## $V
## [1] 1.485401
##
## $A
## [1] 0.4577888
##
## $P
## [1] 1.991859
##
## $R
## [1] 0.2298299
##
## $B
## [1] 1.657327
##
## $D
## [1] 0.2762212
##
## $Re
## [1] 31592.05
##
## $Fr
## [1] 0.4982678
```

```r
# Q = 0.68 cfs, m = 1.5, Sf = 0.002 ft/ft, n = 0.05, units = English units This
# will solve for y since it is missing and y will be in ft
#'
```

Manningrect Examples

```
install.load::load_package("iemisc", "iemiscdata")
#'
#'
# Example Problem 14.4 from Mott (page 379) See nchannel in iemiscdata for the
# Manning's n table that the following example uses Use the normal Manning's n
# value for 1) Natural streams - minor streams (top width at floodstage < 100
# ft), 2) Lined or Constructed Channels, 3) Concrete, and 4) unfinished.
#'
data(nchannel)
#'
nlocation <- grep("unfinished", nchannel$"Type of Channel and Description")
#'
n <- as.numeric(nchannel[nlocation, 3])  # 3 for column 3 - Normal n
#'
Manningrect(Q = 5.75, b = (4.5)^(3/8), Sf = 1.2/100, n = n, units = "SI")
```

```
##
## Flow IS in the rough turbulent zone so the Gauckler-Manning-Strickler equation
##  is acceptable to use.
##
##
## This is supercritical flow.
```

```
## $y
## [1] 0.8784136
##
## $V
## [1] 3.724038
##
## $A
## [1] 1.544023
##
## $P
## [1] 3.514567
##
## $R
## [1] 0.4393209
##
## $B
## [1] 1.75774
##
## $D
## [1] 0.8784136
##
## $Re
## [1] 1629647
##
## $Fr
## [1] 1.268832
```

```
# Q = 5.75 m^3/s, b = (4.50) ^ (3 / 8) m, Sf = 1.2 percent m/m, n = 0.017,
# units = SI units This will solve for y since it is missing and y will be in m
```

```r
#'
#'
#'
# Example Problem 14.5 from Mott (pages 379-380) See nchannel in iemiscdata for
# the Manning's n table that the following example uses Use the normal
# Manning's n value for 1) Natural streams - minor streams (top width at
# floodstage < 100 ft), 2) Lined or Constructed Channels, 3) Concrete, and 4)
# unfinished.
#'
data(nchannel)
#'
nlocation <- grep("unfinished", nchannel$"Type of Channel and Description")
#'
n <- as.numeric(nchannel[nlocation, 3])  # 3 for column 3 - Normal n
#'
Manningrect(Q = 12, b = 2, Sf = 1.2/100, n = n, units = "SI")
```

```
##
## Flow IS in the rough turbulent zone so the Gauckler-Manning-Strickler equation
##  is acceptable to use.
##
##
## This is supercritical flow.

## $y
## [1] 1.347974
##
## $V
## [1] 4.451124
##
## $A
## [1] 2.695948
##
## $P
## [1] 4.695948
##
## $R
## [1] 0.5741009
##
## $B
## [1] 2
##
## $D
## [1] 1.347974
##
## $Re
## [1] 2545397
##
## $Fr
## [1] 1.224246
```

```r
# Q = 12 m^3/s, b = 2 m, Sf = 1.2 percent m/m, n = 0.017, units = SI units This
# will solve for y since it is missing and y will be in m
#'
#'
```

EcoC^{2}S Links

EcoC^{2}S Home – https://www.ecoccs.com/
About EcoC^{2}S – https://www.ecoccs.com/about-ecoc2s.html
Services – https://www.ecoccs.com/services.html
1 Stop Shop – https://www.ecoccs.com/other-biz.html
Products – https://www.questionuniverse.com/products.html
Media – https://www.ecoccs.com/media.html
Resources – https://www.ecoccs.com/resources.html
R Trainings and Resources provided by EcoC^{2}S (Irucka Embry, EIT) – https://www.ecoccs.com/rtraining.html

Copyright and License