# ES4-P2

February 16, 2025

[29]:
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%reset -f
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[30]:
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# ES4 Problem 2

# Hazen Williams SI
def flowhw(coef, diameter, slope):
    import math
    area = 0.25 * math.pi * diameter**2
    radius = diameter / 4.0
    flowhw = 0.849 * coef * area * (radius**0.63) * (slope**0.54)
    return flowhw

import matplotlib.pyplot as plt

# Parameters
length = 3050  # m
diameter = 1.5  # m
ch = 130  # Hazen-Williams coefficient (ABS look up online)

# Initialize variables
howMany = 10000  # search region
head_loss_values = [0 for i in range(howMany)]
for i in range(howMany):
    head_loss_values[i]=i/100 # search increment
flow_values = []

# Calculate flow rates for each head_loss
for head_loss in head_loss_values:
    slope = head_loss / length
    flow_values.append(flowhw(ch, diameter, slope))
```

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# Plot head_loss vs flow
plt.figure(figsize=(5, 3))
plt.plot(head_loss_values, flow_values, label="Flow vs Head Loss", color="blue")
plt.title("Hazen-Williams: Head Loss vs Flow Rate")
plt.xlabel("Head Loss (m)")
plt.ylabel("Flow Rate (cms)")
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plt.grid(True)
plt.legend()
plt.show()
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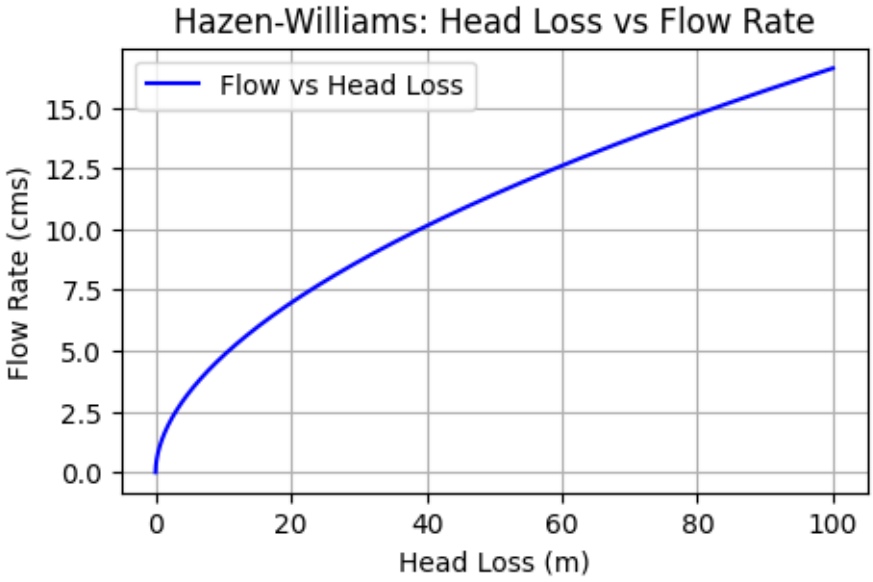


[32]:
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def find_closest_index(lst, target):
    return min(range(len(lst)), key=lambda i: abs(lst[i] - target))

# Example Usage
target_value = 8.35
index = find_closest_index(flow_values, target_value)
print(f"The index of the closest value to {target_value} is {index}.")
print(f"The closest value is {flow_values[index]}.")
print(f"The head loss is {head_loss_values[index]}.")
```

```
The index of the closest value to 8.35 is 2800.
The closest value is 8.350386249708711.
The head loss is 28.0.
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