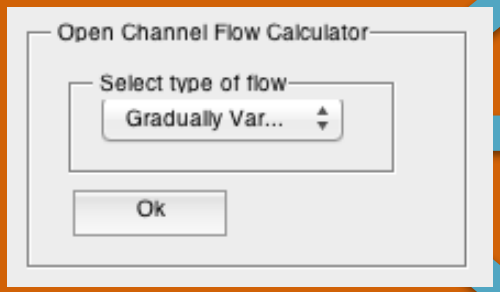
OPEN CHANNEL FLOW TOOL USING MATLAB



Rapidly Varied Flow

Gradually Varied Flow

Uniform Flow

Bhavya Reddy

H0700: Open Channel Flow

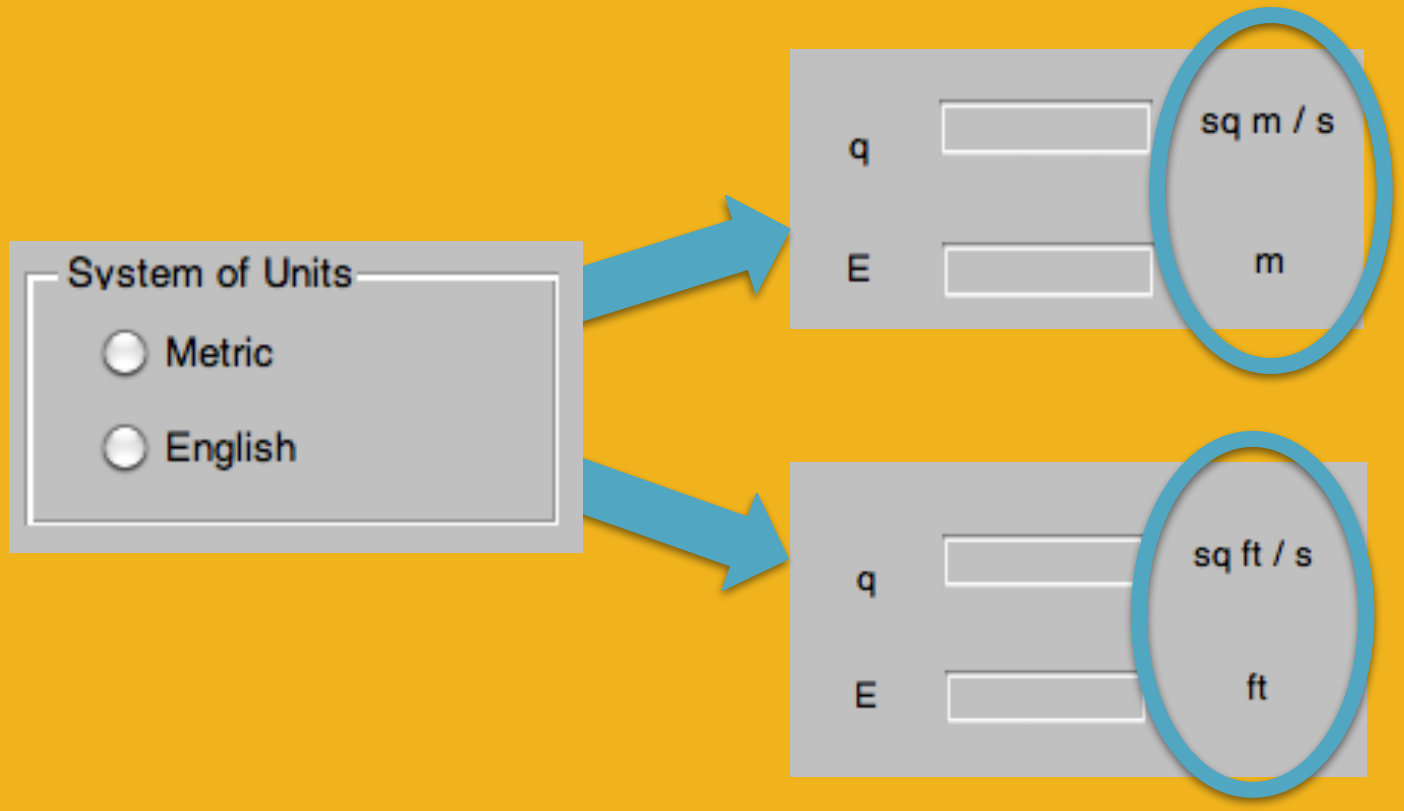
Professor Piasecki

Spring 2014

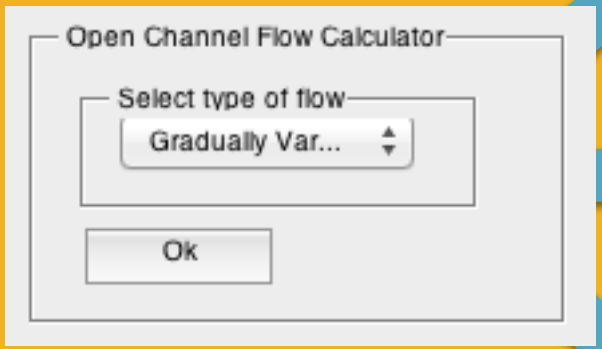
MATLAB

- GUIDE
- Built in functions
  - Roots (p)
  - ODE45

GUIDE: DYNAMIC ELEMENTS



CALCULATOR SELECTION

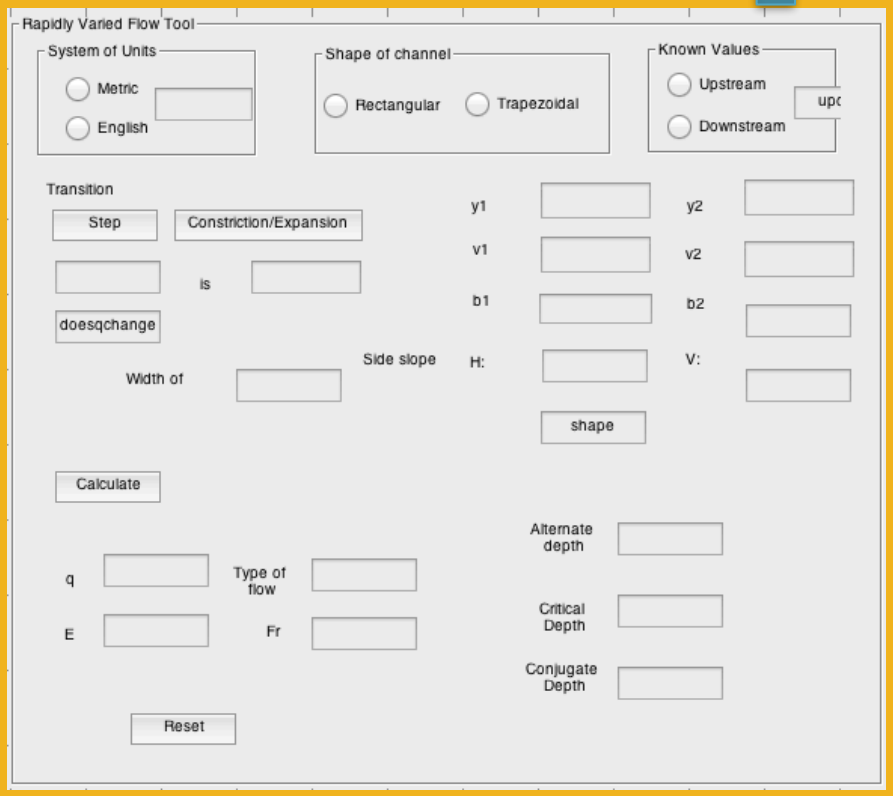


*Rapidly Varied Flow

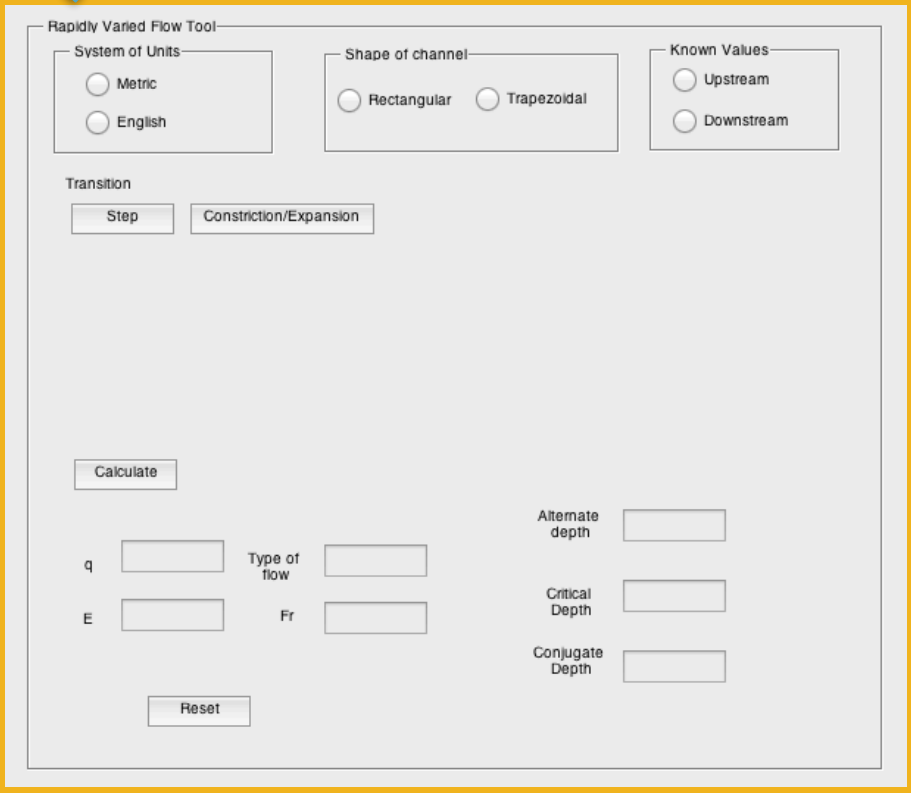
*Gradually Varied Flow

Uniform Flow

VISIBILITY

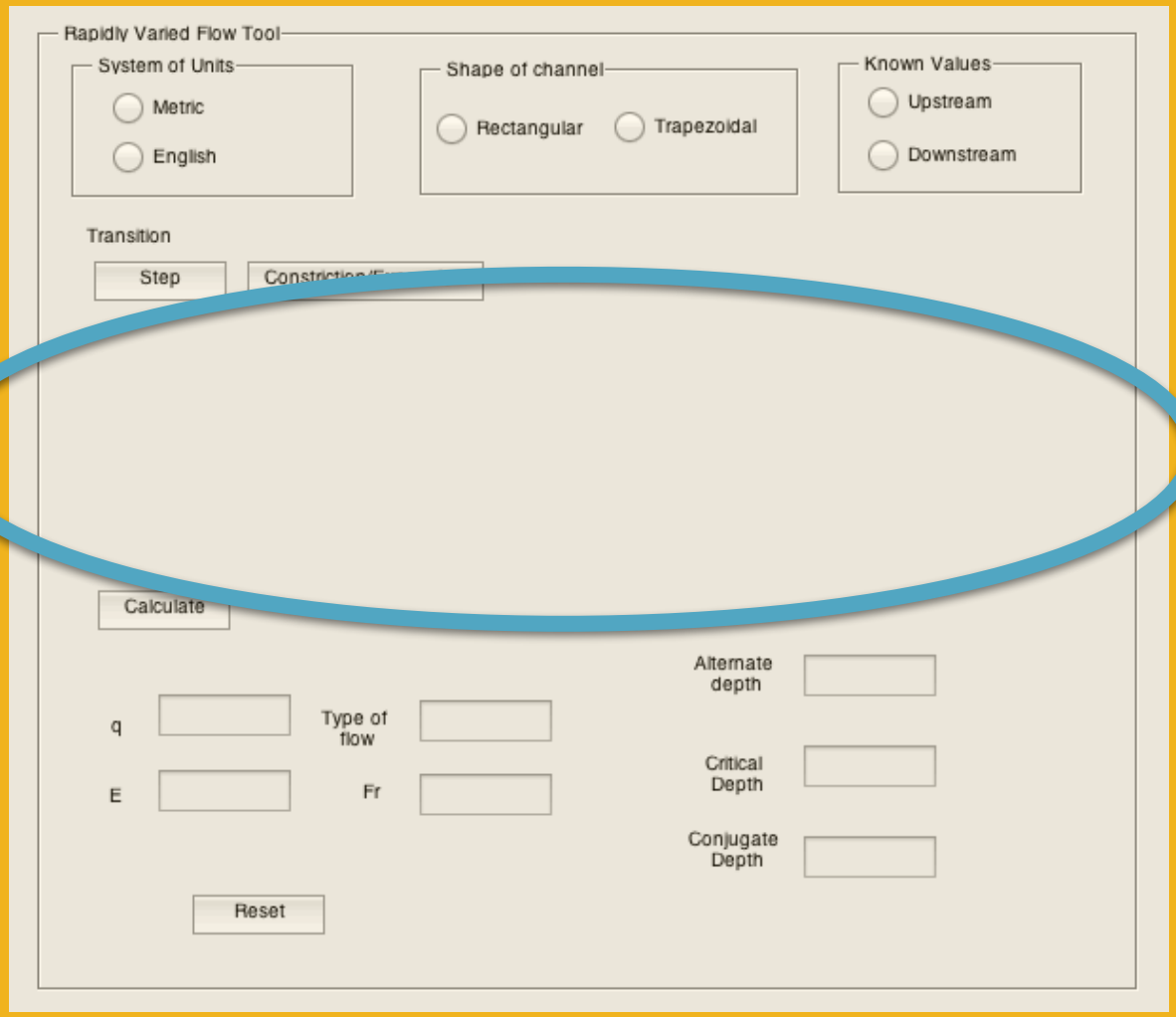


Back end - Cluttered



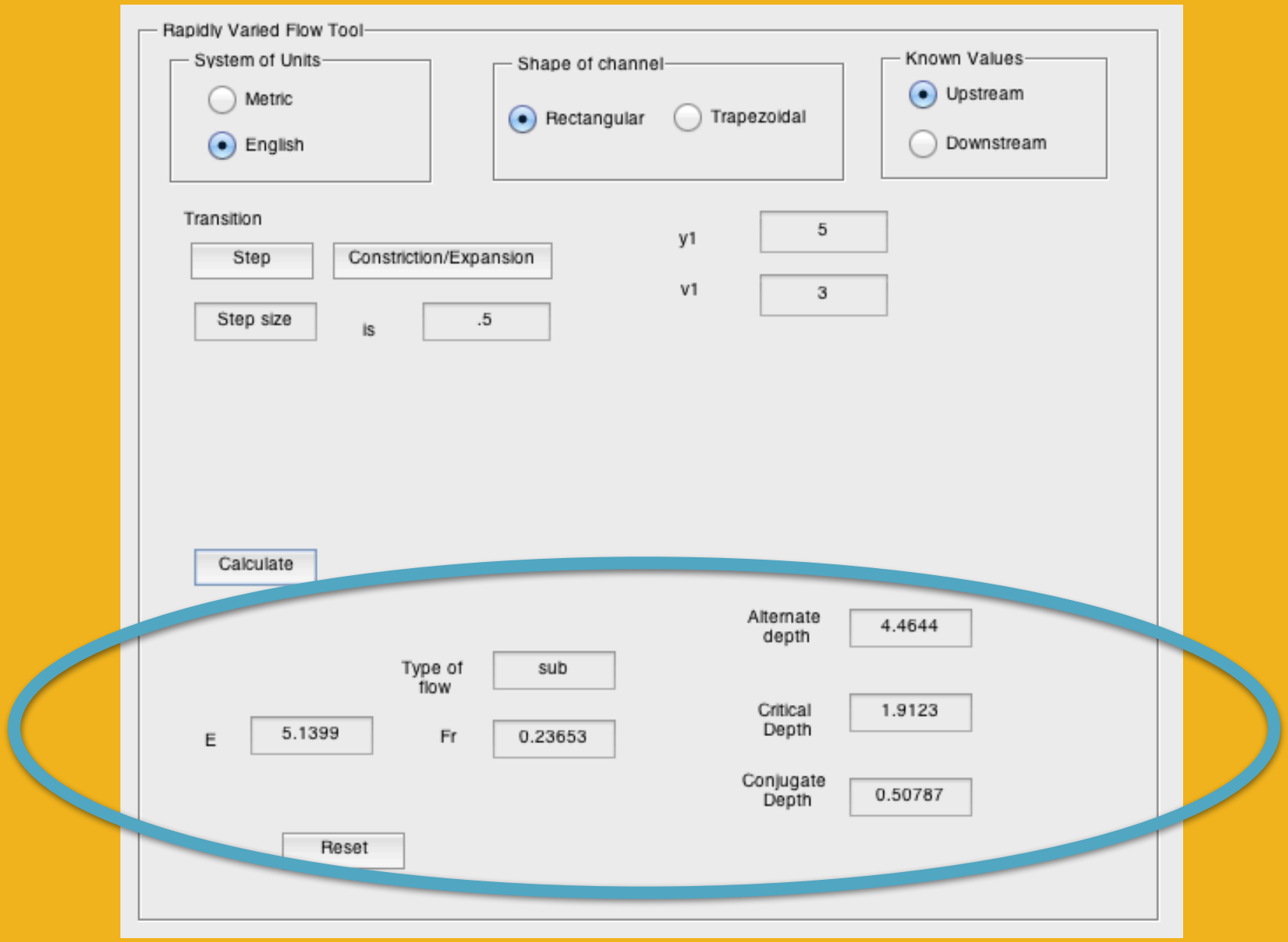
UI - Streamlined

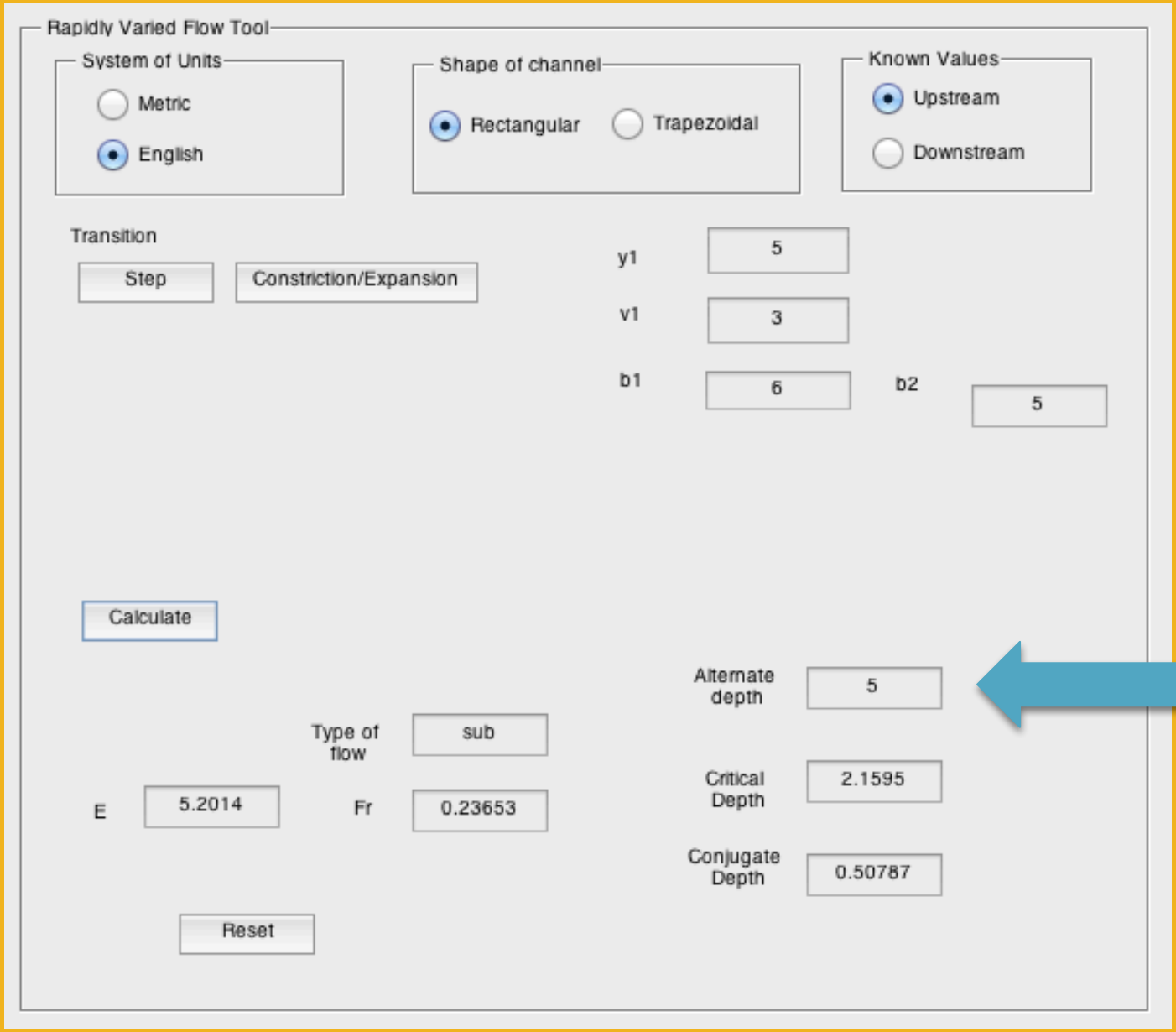
RAPIDLY VARIED FLOW



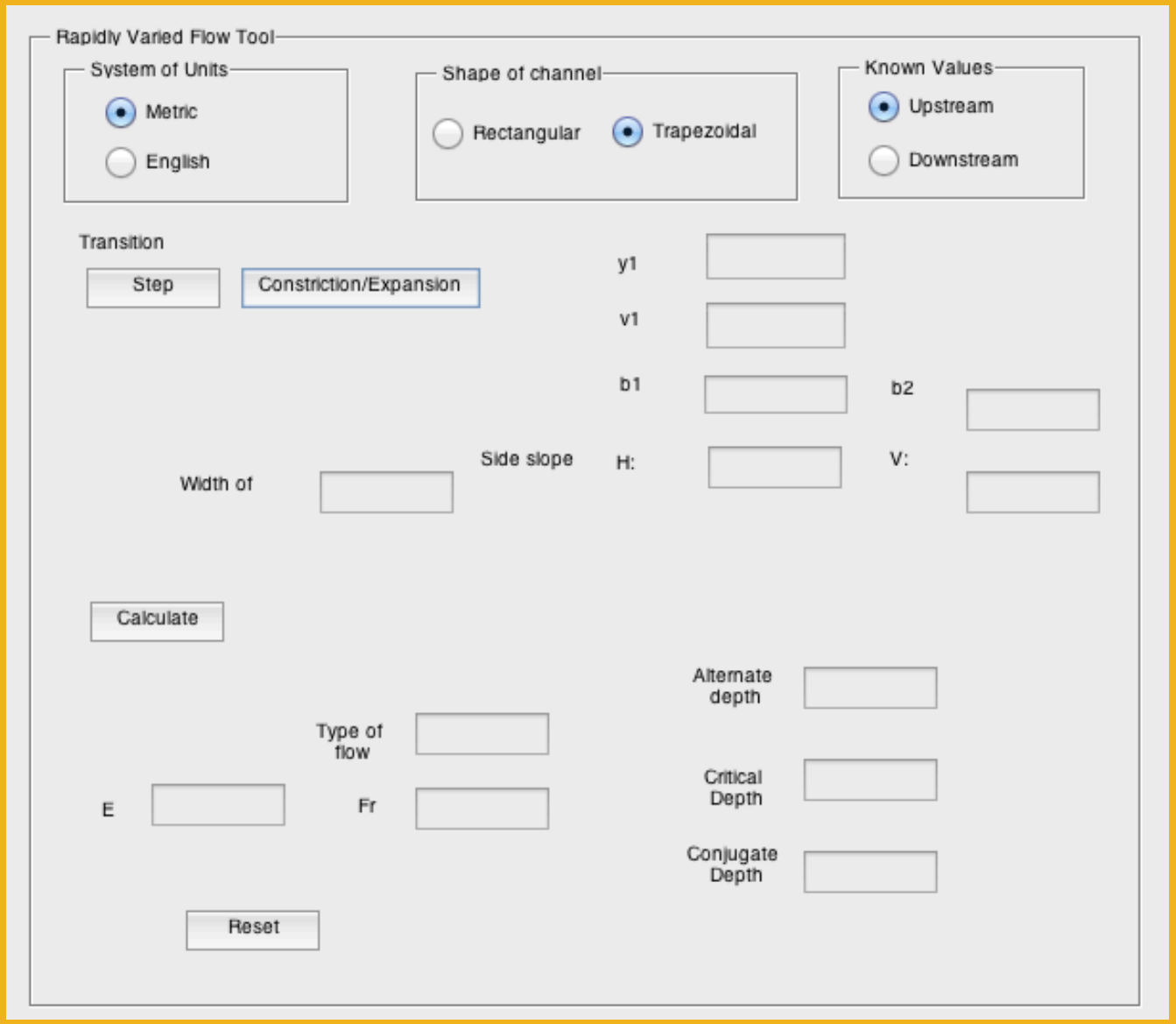
Customize input fields

RAPIDLY VARIED FLOW (CONT'D)


Rapidly Varied Flow Tool
System of Units
Metric
English
Shape of channel
Rectangular
Trapezoidal
Known Values
Upstream
Downstream
Transition
Step
Constriction/Expansion
Step size
is
.5
y1
5
v1
3
Calculate
Alternate depth
4.4644
Type of flow
sub
Critical Depth
1.9123
E
5.1399
Fr
0.23653
Conjugate Depth
0.50787
Reset


Rapidly Varied Flow Tool
System of Units
Metric
English
Shape of channel
Rectangular
Trapezoidal
Known Values
Upstream
Downstream
Transition
Step
Constriction/Expansion
y1
5
v1
3
b1
6
b2
5
Calculate
Alternate depth
5
Type of flow
sub
Critical Depth
2.1595
E
5.2014
Fr
0.23653
Conjugate Depth
0.50787
Reset

r = roots(p)



Functionality: Shapes

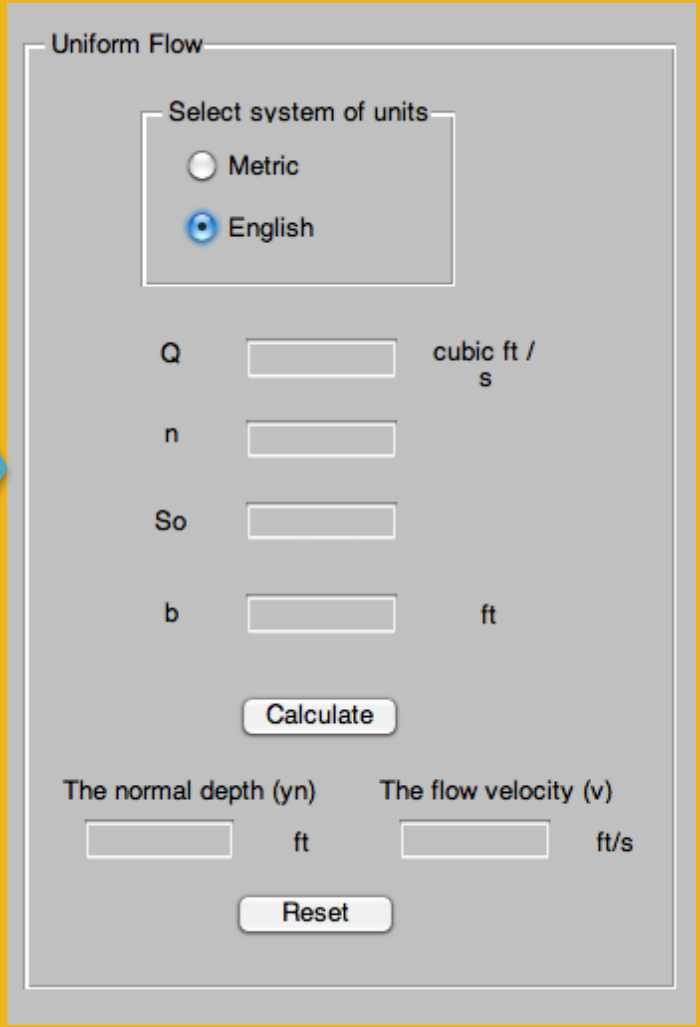
+

Design: Input flexibility

UNIFORM FLOW

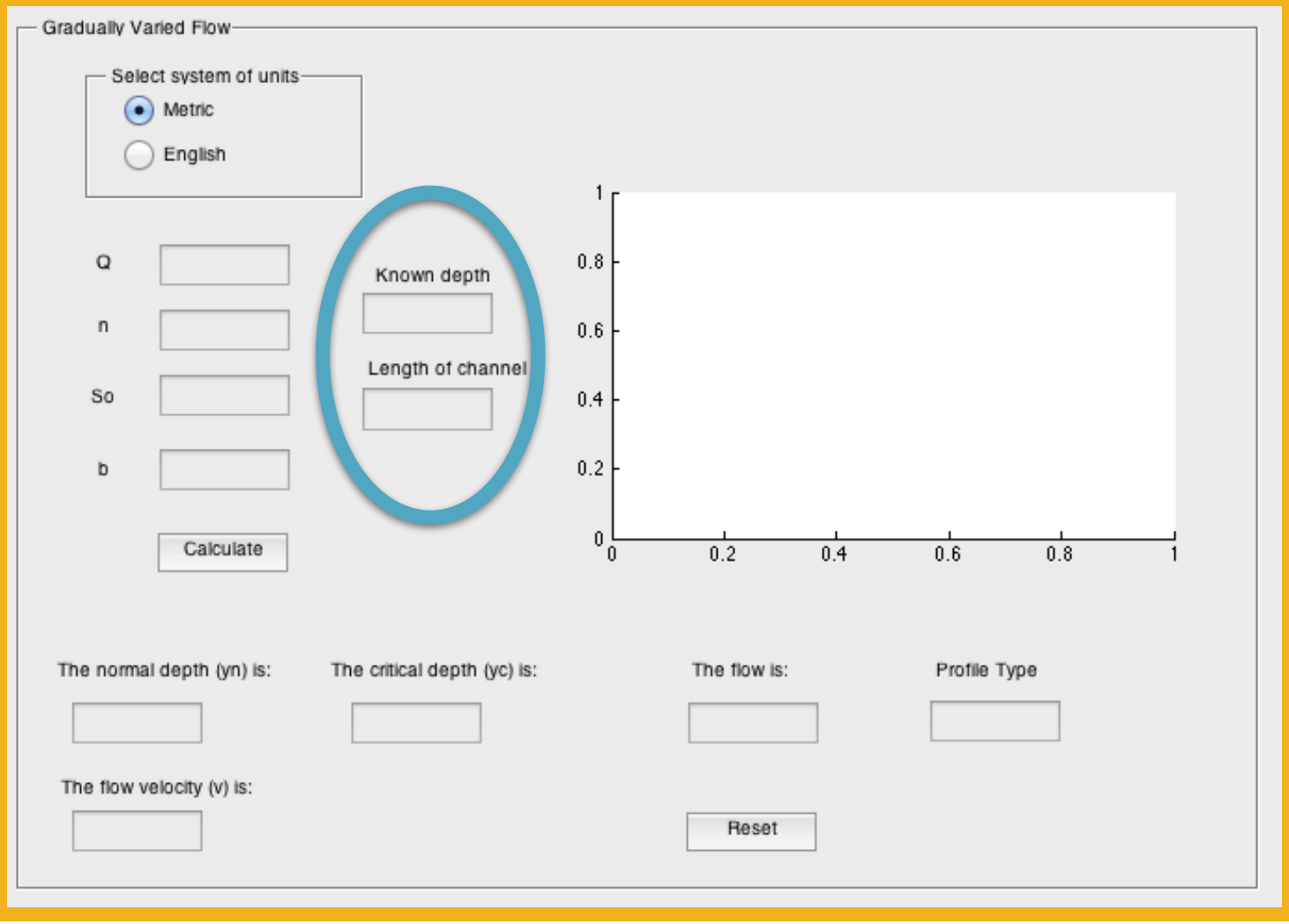
$$Q = VA = \left(\frac{1.49}{n}\right) AR^{\frac{2}{3}} \sqrt{S} \quad [U.S.]$$

$$Q = VA = \left(\frac{1.00}{n}\right) AR^{\frac{2}{3}} \sqrt{S} \quad [SI]$$



Fixed point iteration

GRADUALLY VARIED FLOW



Gradually Varied Flow

Select system of units

- Metric
- English

Q	52.972
n	.016
So	.0008
b	13.1234

Known depth: .9842

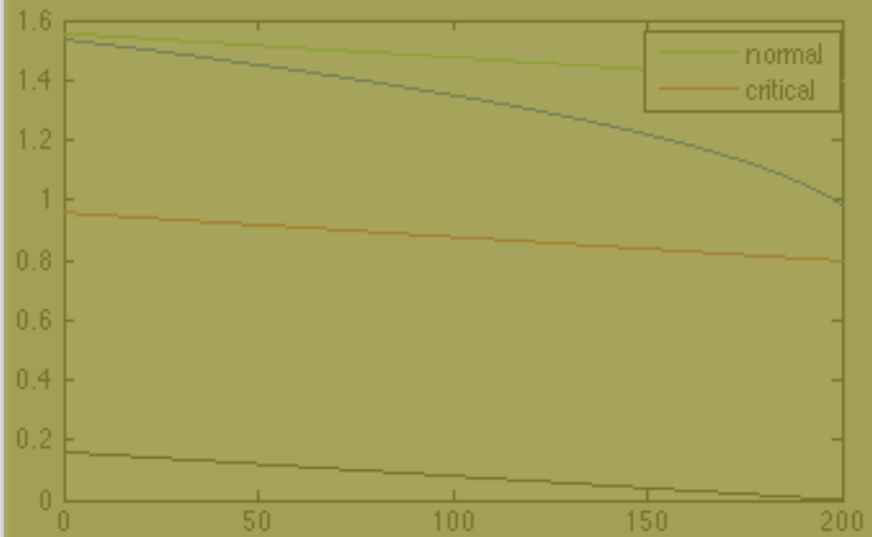
Length of channel: 200

Calculate

The normal depth (yn) is: 1.39514

The critical depth (yc) is: 0.797073

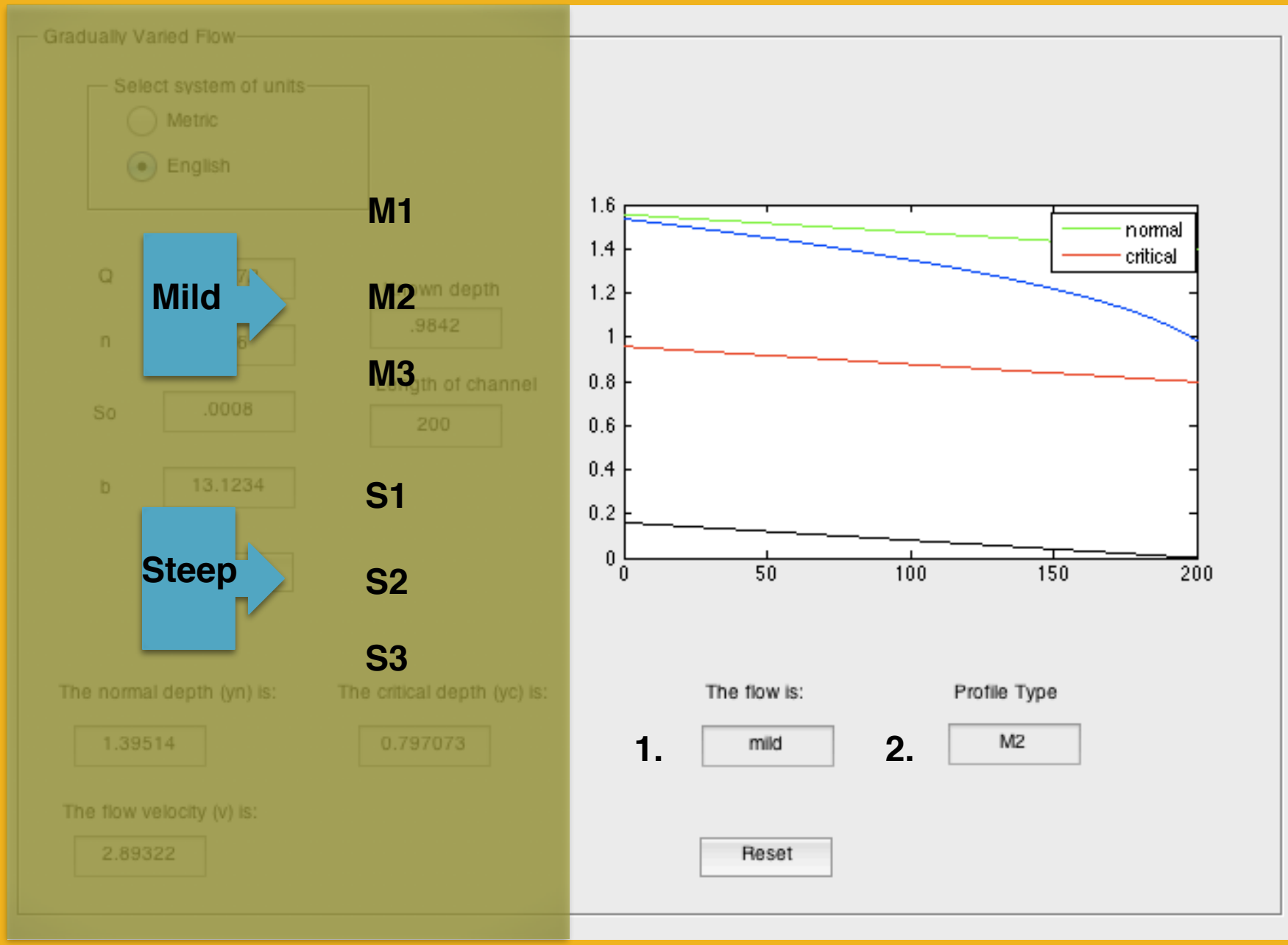
The flow velocity (v) is: 2.89322

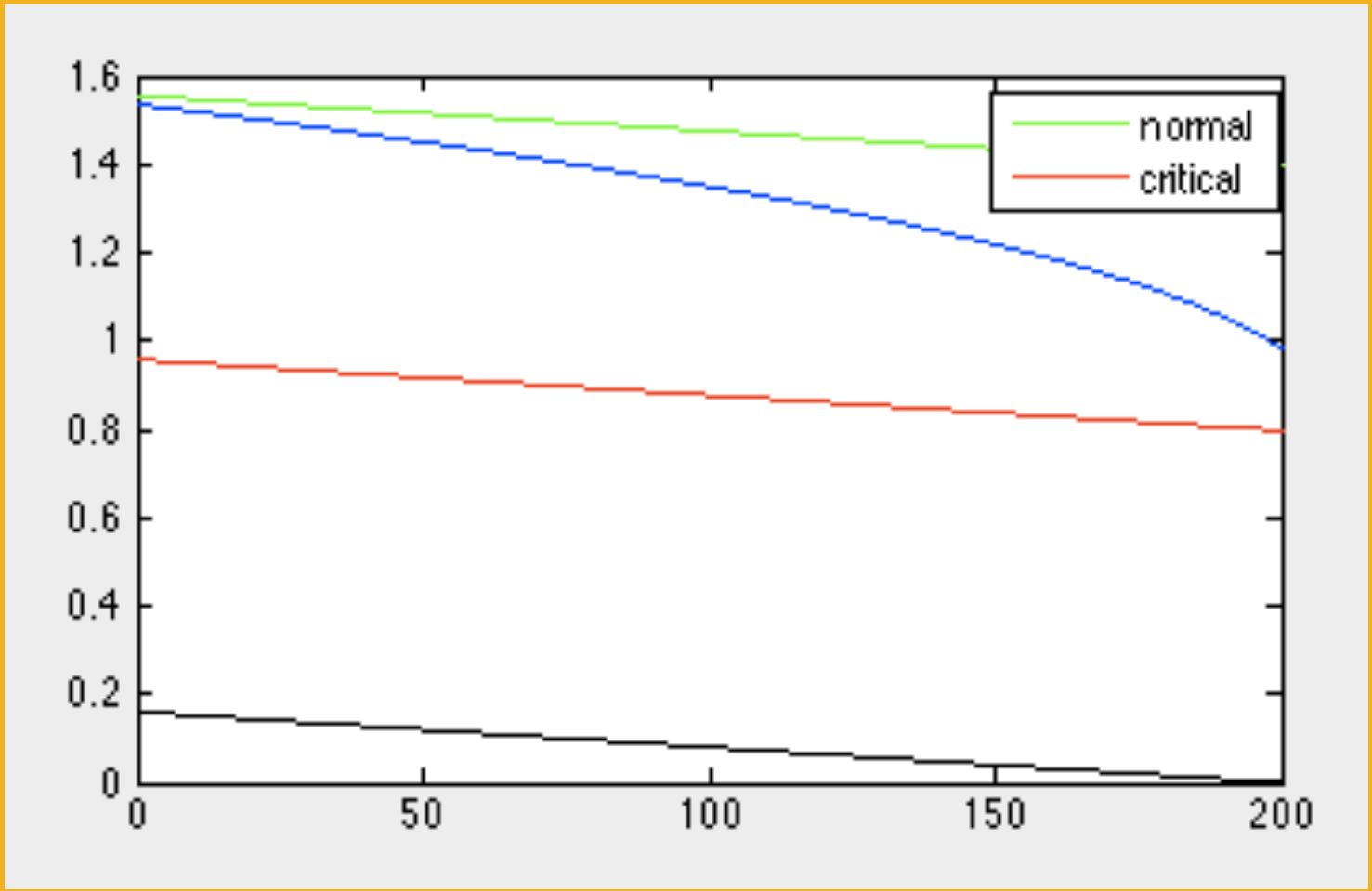


The flow is: mild

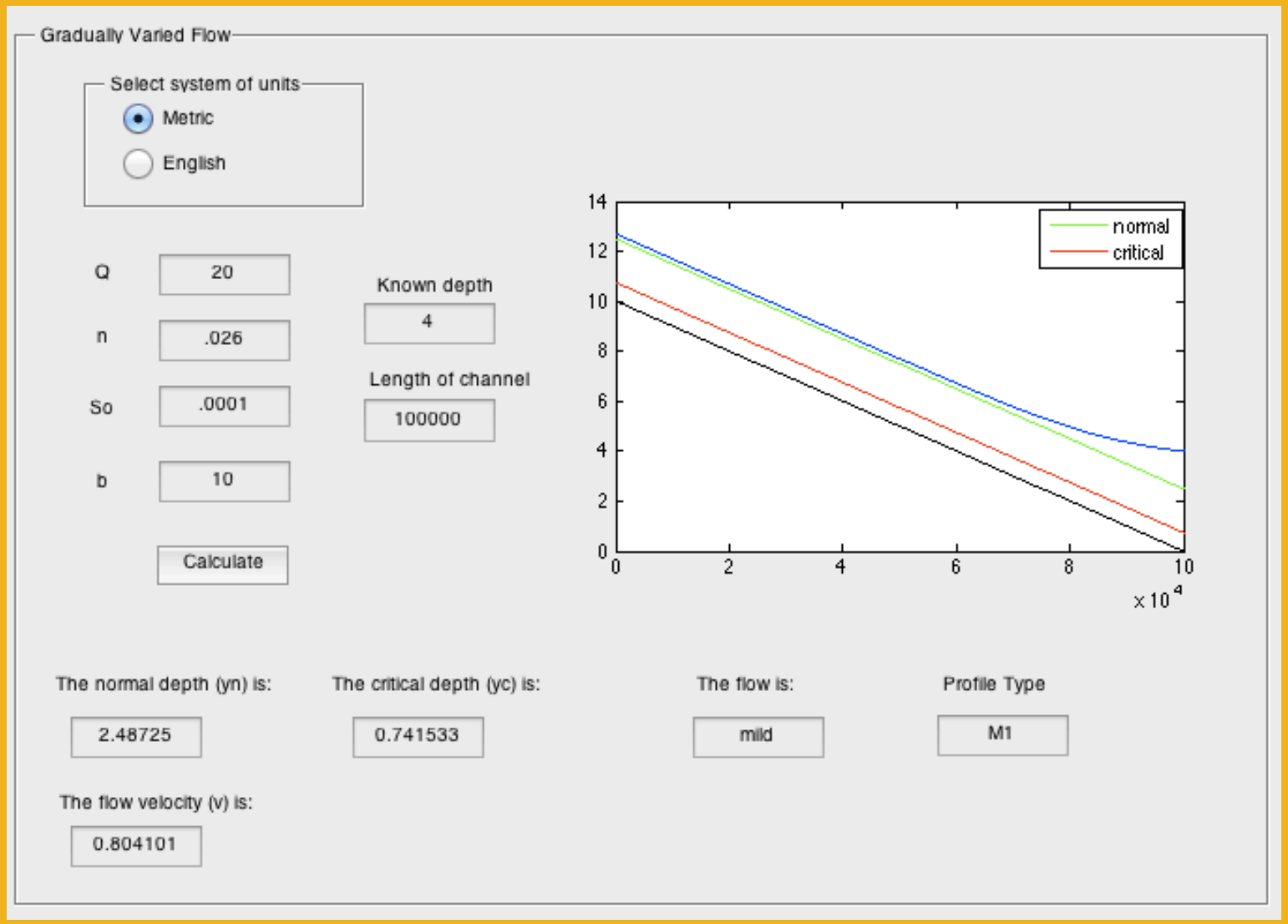
Profile Type: M2

Reset

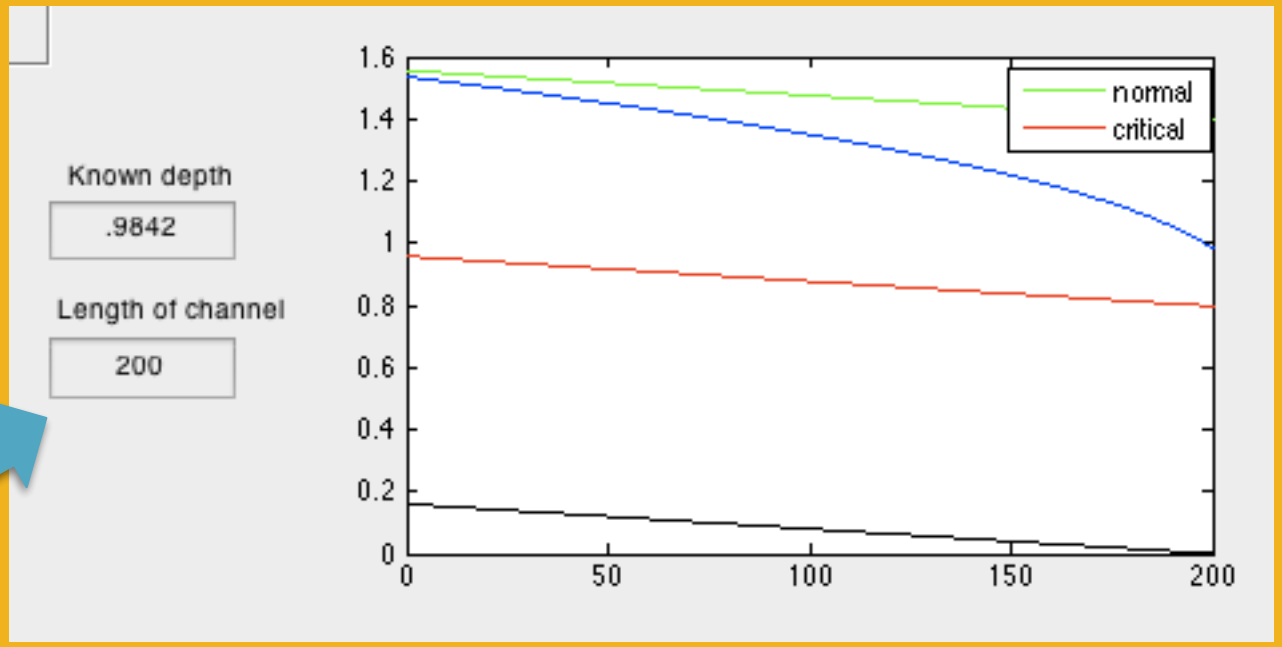

Gradually Varied Flow
Select system of units
Metric
English
Mild
Steep
M1
M2
M3
S1
S2
S3
Q
n
So
.0008
b
13.1234
.9842
200
The normal depth (yn) is:
1.39514
The critical depth (yc) is:
0.797073
The flow velocity (v) is:
2.89322
normal
critical
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
0
50
100
150
200
The flow is:
1.
mild
Profile Type
2.
M2
Reset

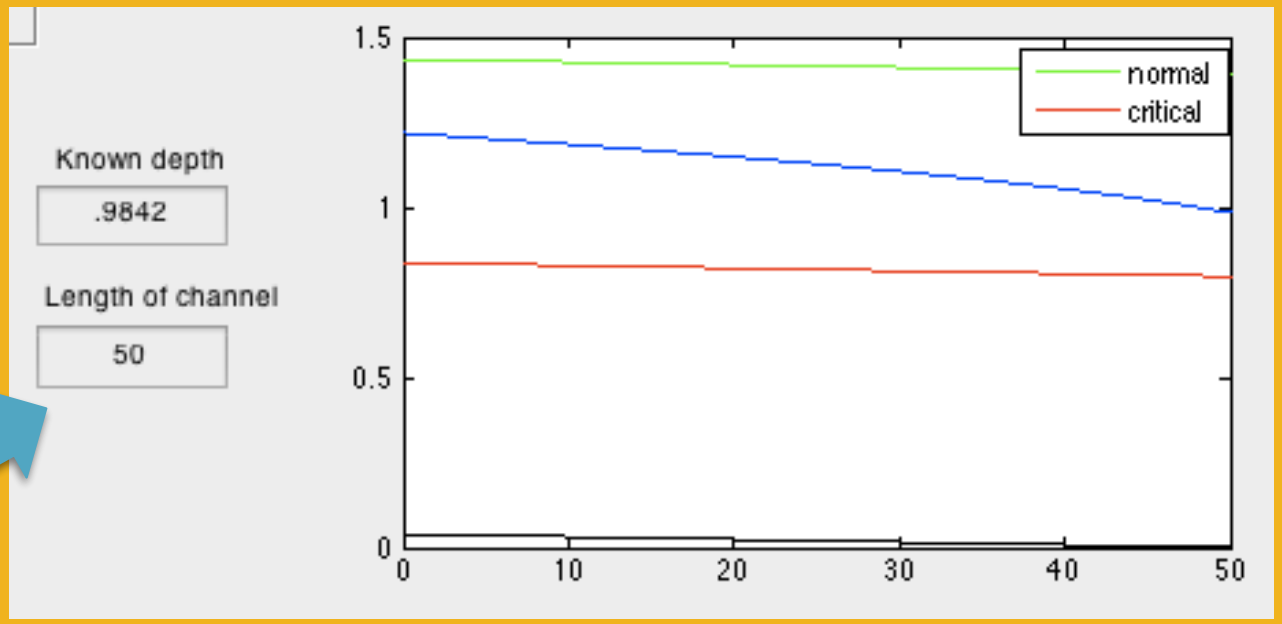


ODE45 (4th order Runge-Kutta) **[Sanders – UC IRVINE}**



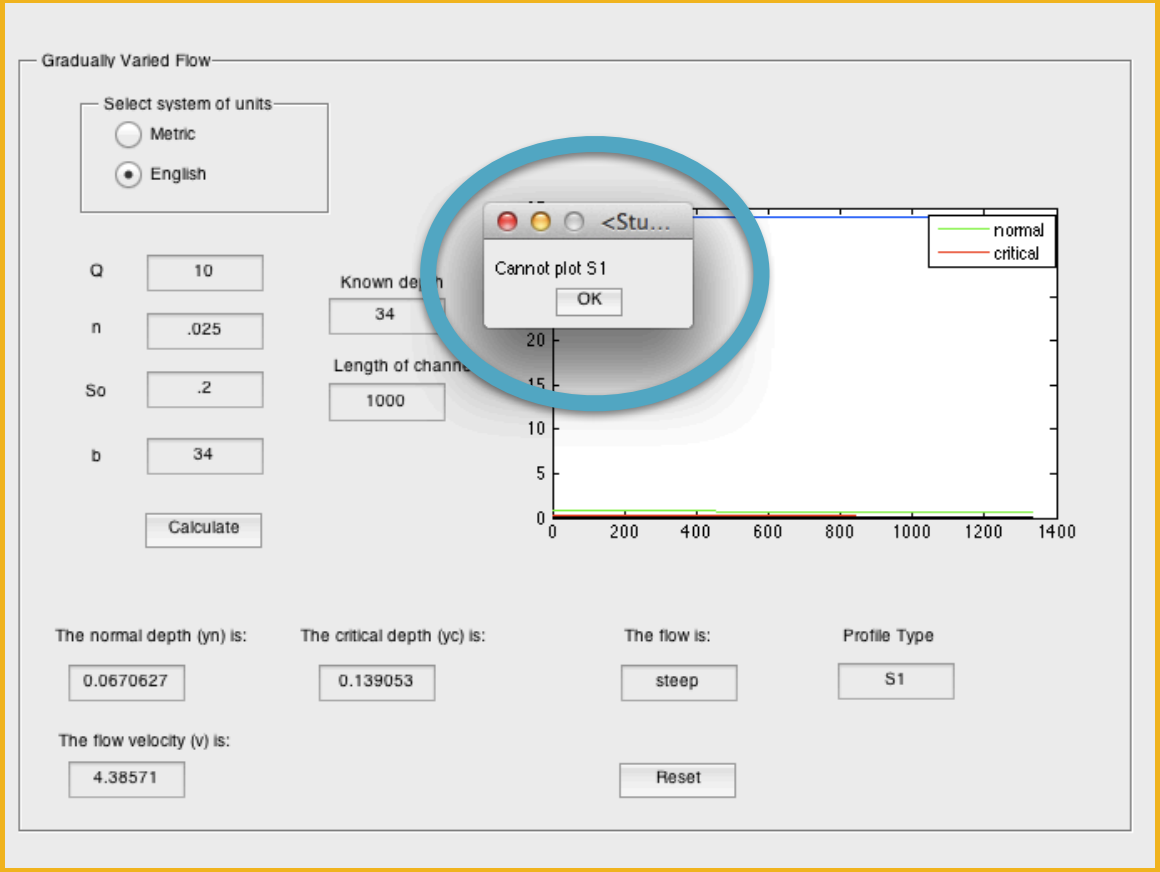
- 1 or +1 coefficient


Known depth
.9842
Length of channel
200
normal
critical
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
0
50
100
150
200


Known depth
.9842
Length of channel
50
normal
critical
1.5
1
0.5
0
0
10
20
30
40
50

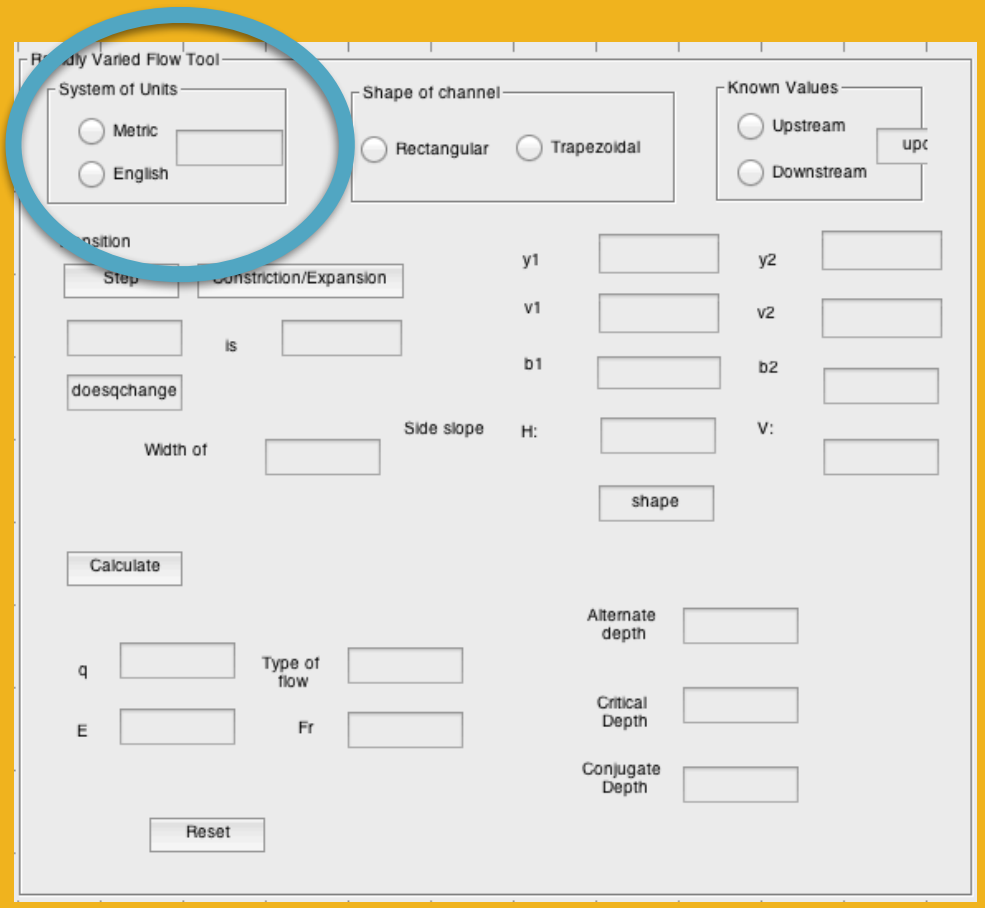
IMPROVEMENTS: FUNCTIONALITY

- Surface profiles: fully functional
  - Hydraulic jump



IMPROVEMENTS: FUNCTIONALITY

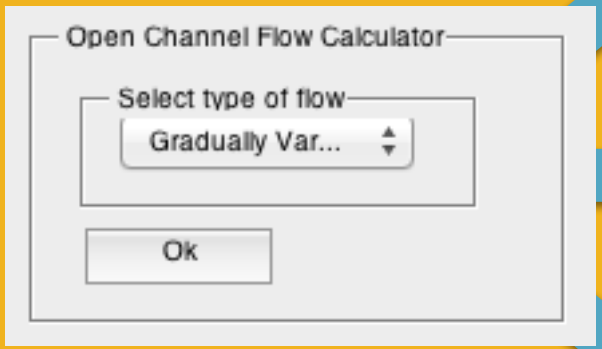
- Shapes/Compound
- Elegance of value recall
  - Direct transfer



IMPROVEMENTS: GUI DESIGN

- Condense windows
  - Change panel visibility
- Alert physically unrealistic values

SUMMARY



*Rapidly Varied Flow
- Customized input fields
  - Visibility
- Root-finder

*Gradually Varied Flow
- Set input fields
- ODE 45

Uniform Flow

SOURCES

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