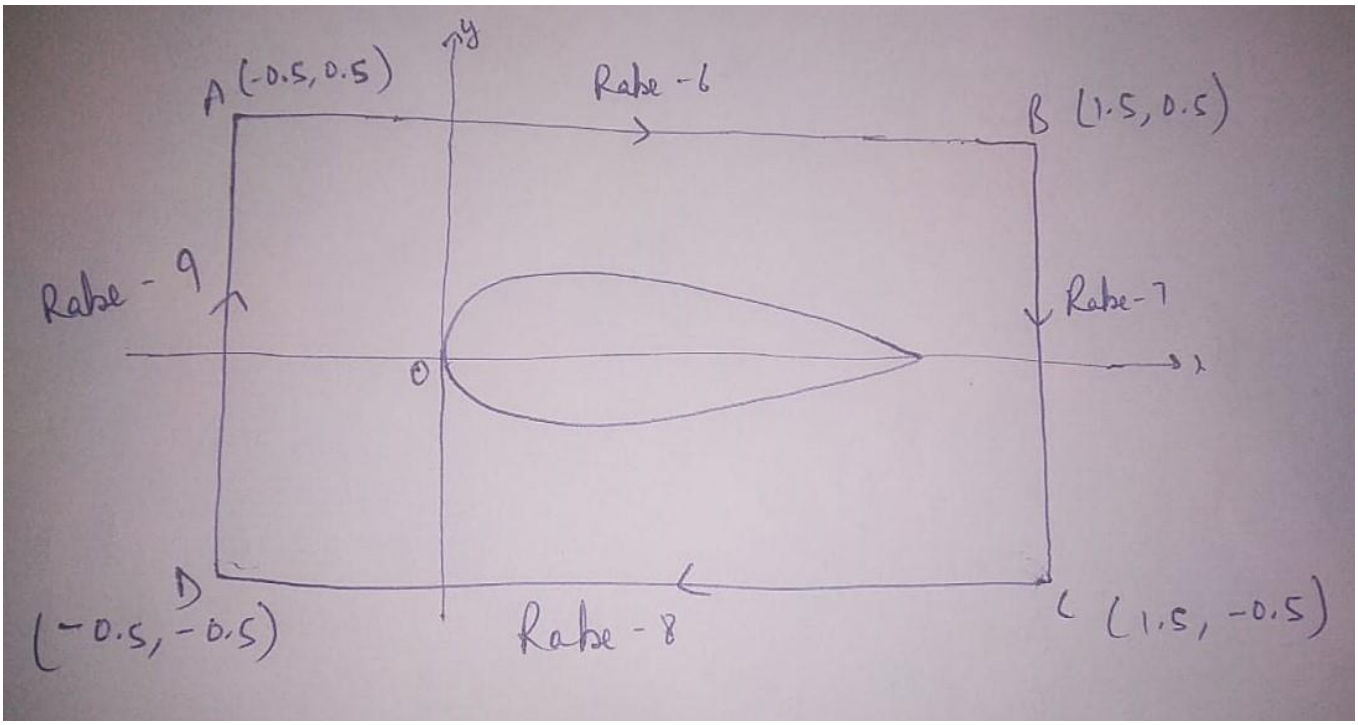
Name	Harsh Sharma
Roll no.	19AE30022

NACA 0012 symmetric airfoil

For 0° angle of attack



$$\text{Circulation} = \int_A^B \boldsymbol{v}.\boldsymbol{dl} + \int_B^C \boldsymbol{v}.\boldsymbol{dl} + \int_C^D \boldsymbol{v}.\boldsymbol{dl} + \int_D^A \boldsymbol{v}.\boldsymbol{dl}$$

= 223.9 - 17.66 - 169.8 +43.93

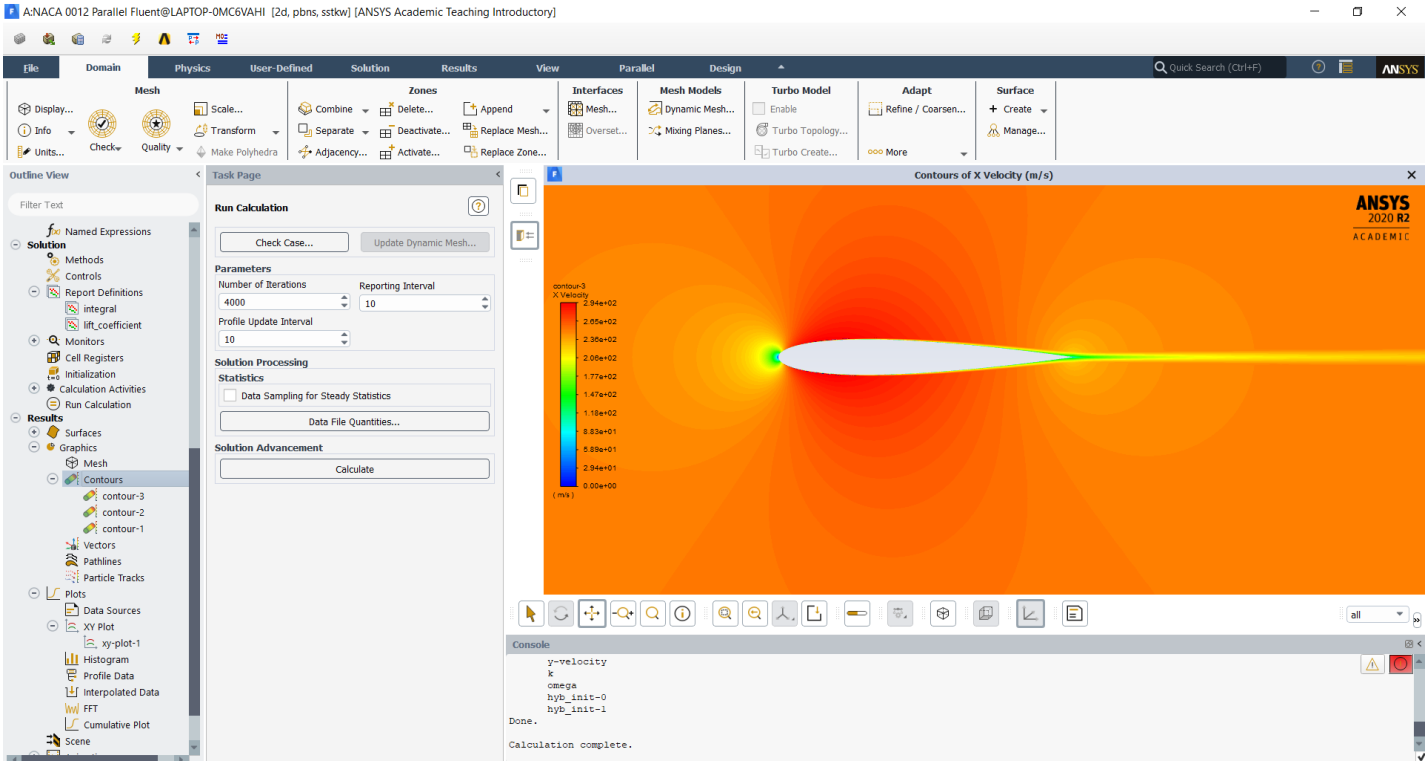
= 80.37

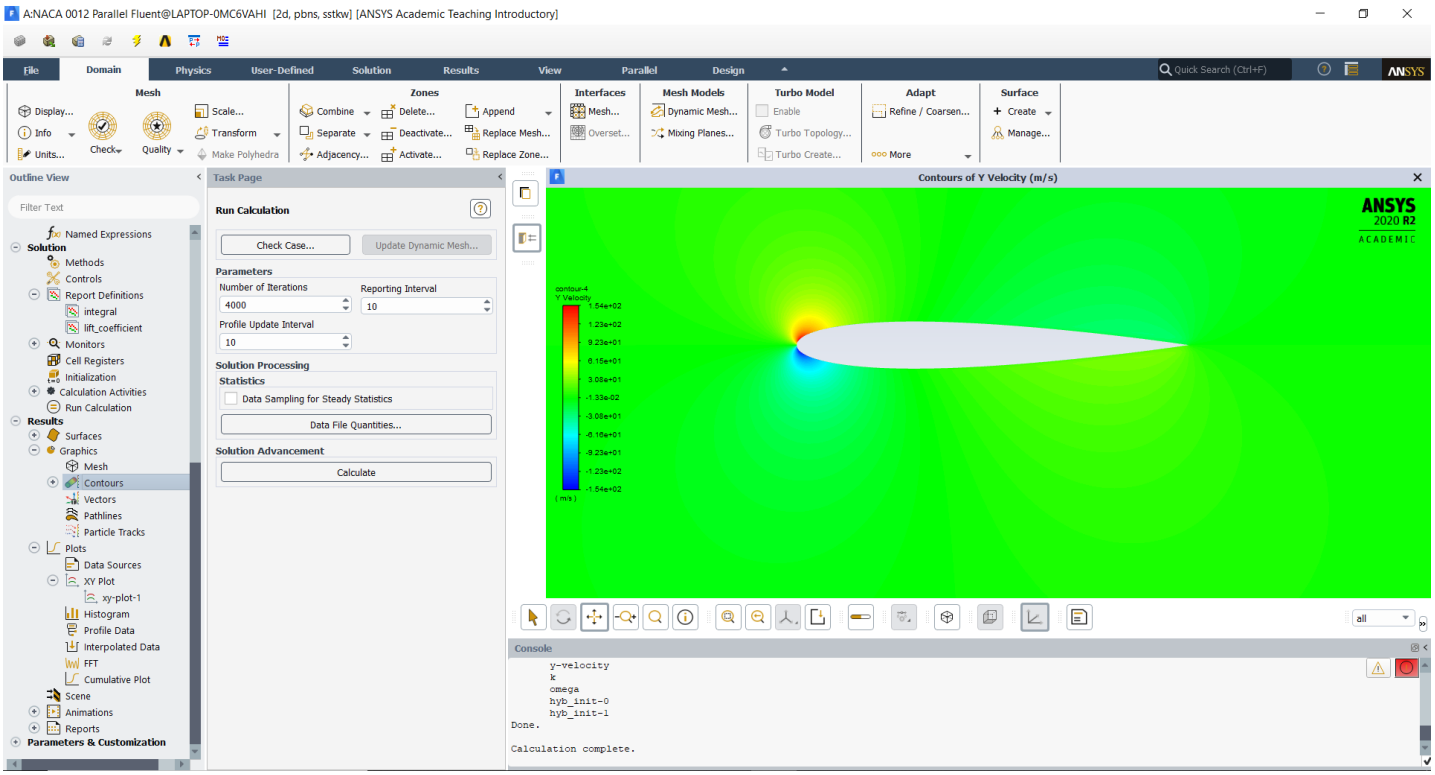
Air density = 1.225 Kg/m^3

Freestream velocity = 250m/s

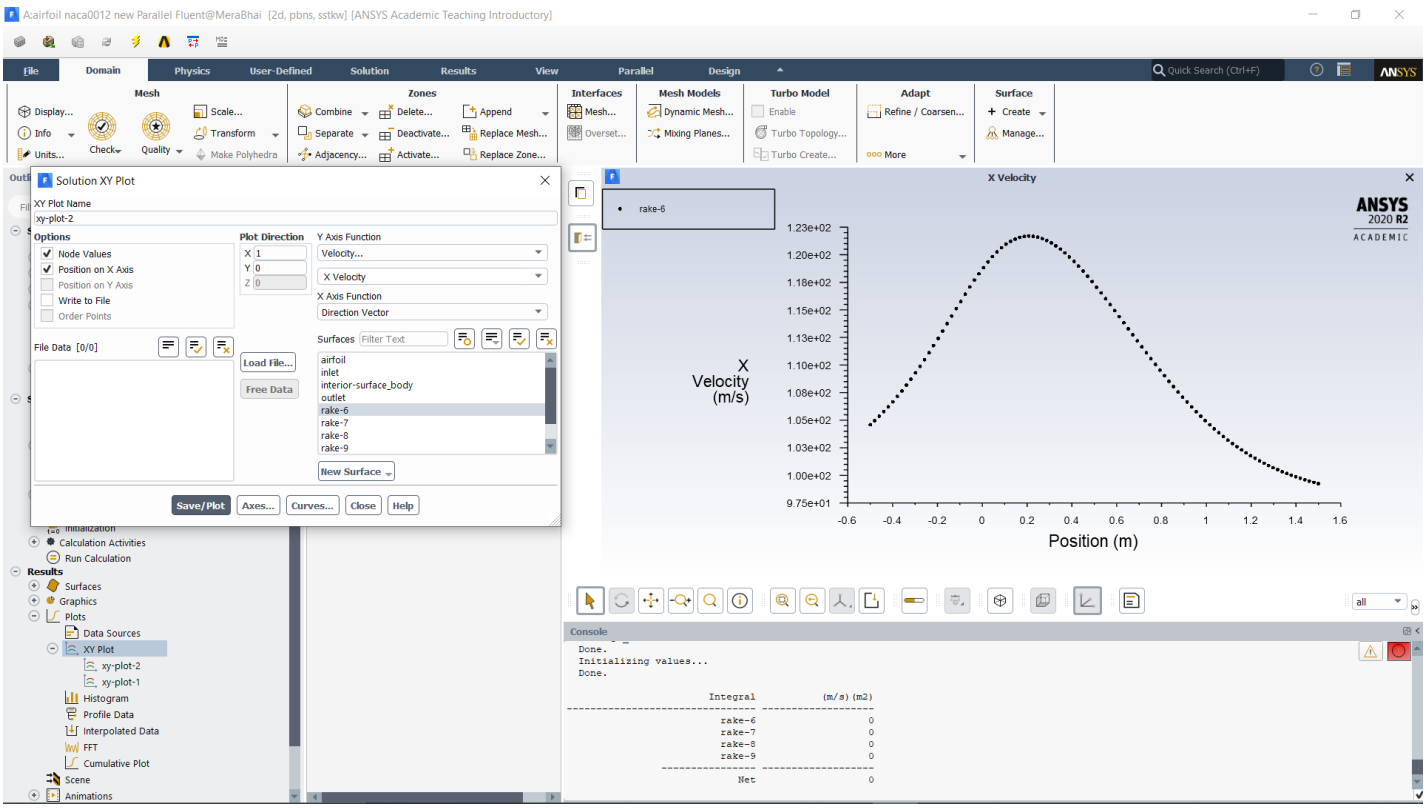
Lift = (Air density)*(Freestream velocity)*(circulation)

= 1.225*250*80.37 = 24613.3125 N

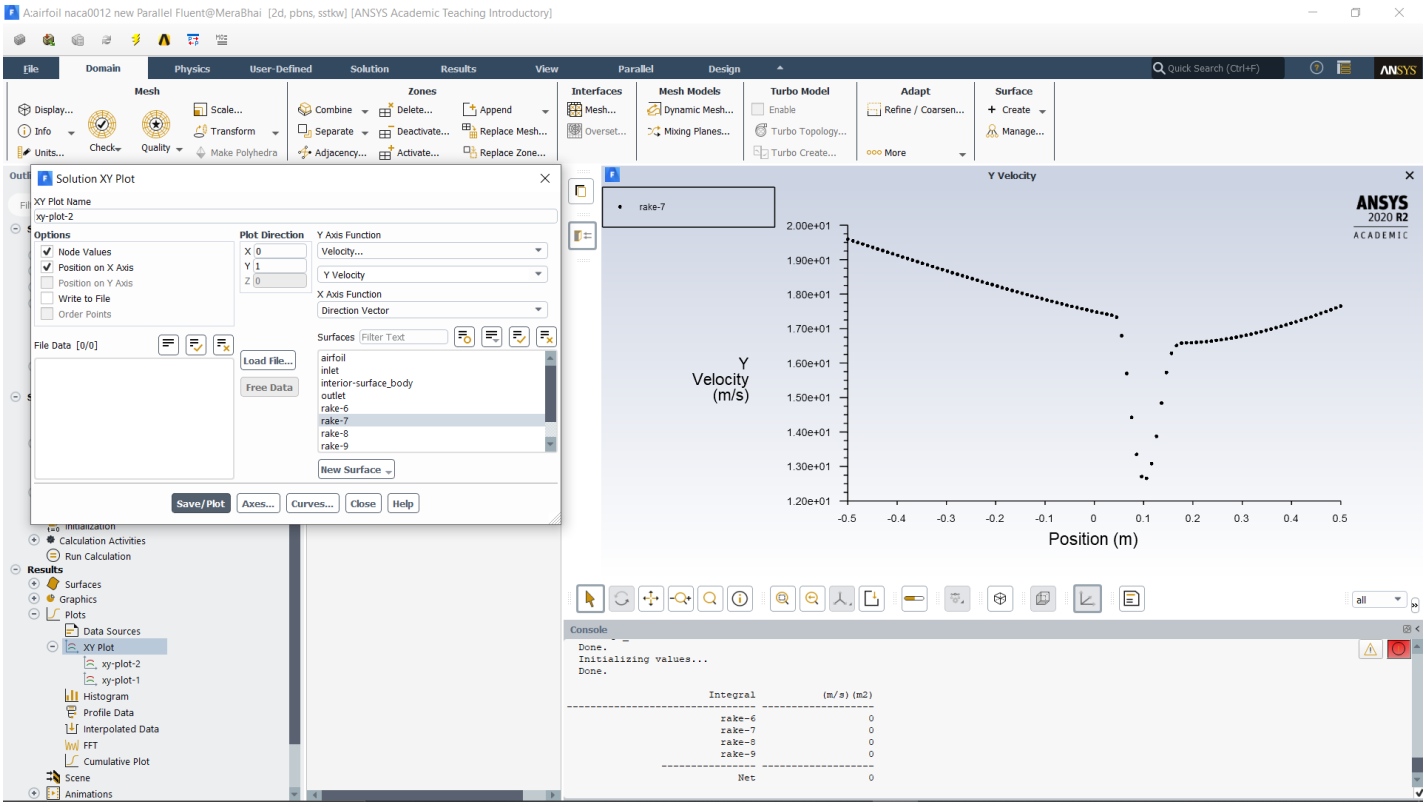

A:NACA 0012 Parallel Fluent@LAPTOP-0MC6VAHI [2d, pbns, sstkw] [ANSYS Academic Teaching Introductory]
File
Domain
Physics
User-Defined
Solution
Results
View
Parallel
Design
Outline View
Task Page
Run Calculation
Check Case...
Update Dynamic Mesh...
Parameters
Number of Iterations
4000
Reporting Interval
10
Profile Update Interval
10
Solution Processing
Statistics
Data Sampling for Steady Statistics
Data File Quantities...
Solution Advancement
Calculate
Contours of X Velocity (m/s)
ANSYS
2020 R2
ACADEMIC
Console
y-velocity
k
omega
hyb_init-0
hyb_init-1
Done.
Calculation complete.


A:NACA 0012 Parallel Fluent@LAPTOP-0MC6VAHI [2d, pbns, sstkw] [ANSYS Academic Teaching Introductory]
File
Domain
Physics
User-Defined
Solution
Results
View
Parallel
Design
Outline View
Task Page
Run Calculation
Check Case...
Update Dynamic Mesh...
Parameters
Number of Iterations
4000
Reporting Interval
10
Profile Update Interval
10
Solution Processing
Statistics
Data Sampling for Steady Statistics
Data File Quantities...
Solution Advancement
Calculate
Contours of Y Velocity (m/s)
ANSYS
2020 R2
ACADEMIC
Console
y-velocity
k
omega
hyb_init-0
hyb_init-1
Done.
Calculation complete.

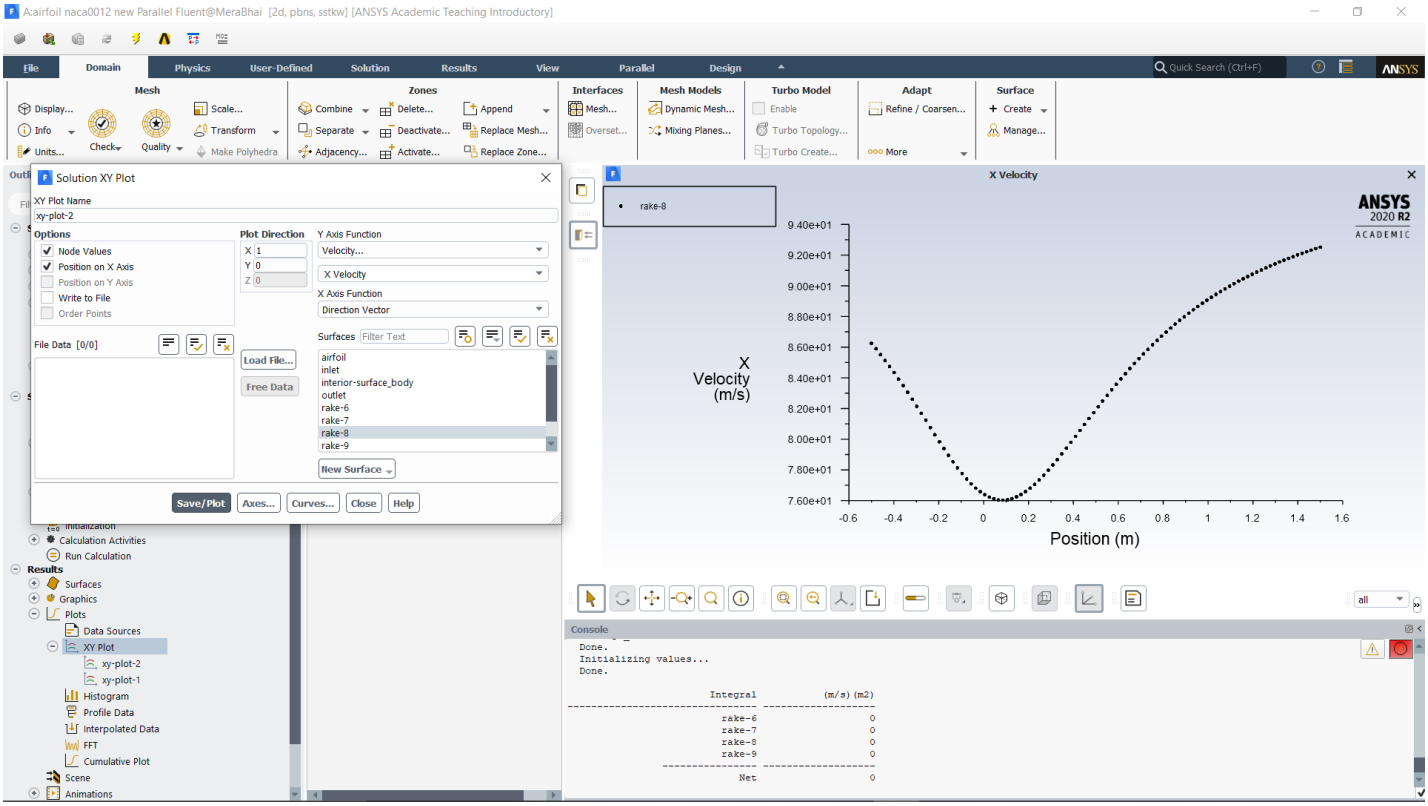
Rake-6


Solution XY Plot
XY Plot Name
xy-plot-2
Options
Node Values
Position on X Axis
Position on Y Axis
Write to File
Order Points
Plot Direction
Y Axis Function
Velocity...
X Velocity
X Axis Function
Direction Vector
Surfaces
Filter Text
airfoil
inlet
interior-surface_body
outlet
rake-6
rake-7
rake-8
rake-9
File Data [0/0]
Load File...
Free Data
New Surface
Save/Plot
Axes...
Curves...
Close
Help
X Velocity
rake-6
X Velocity (m/s)
Position (m)
ANSYS 2020 R2 ACADEMIC
Console
Done.
Initializing values...
Done.
Integral (m/s) (m2)
rake-6 0
rake-7 0
rake-8 0
rake-9 0
Net 0

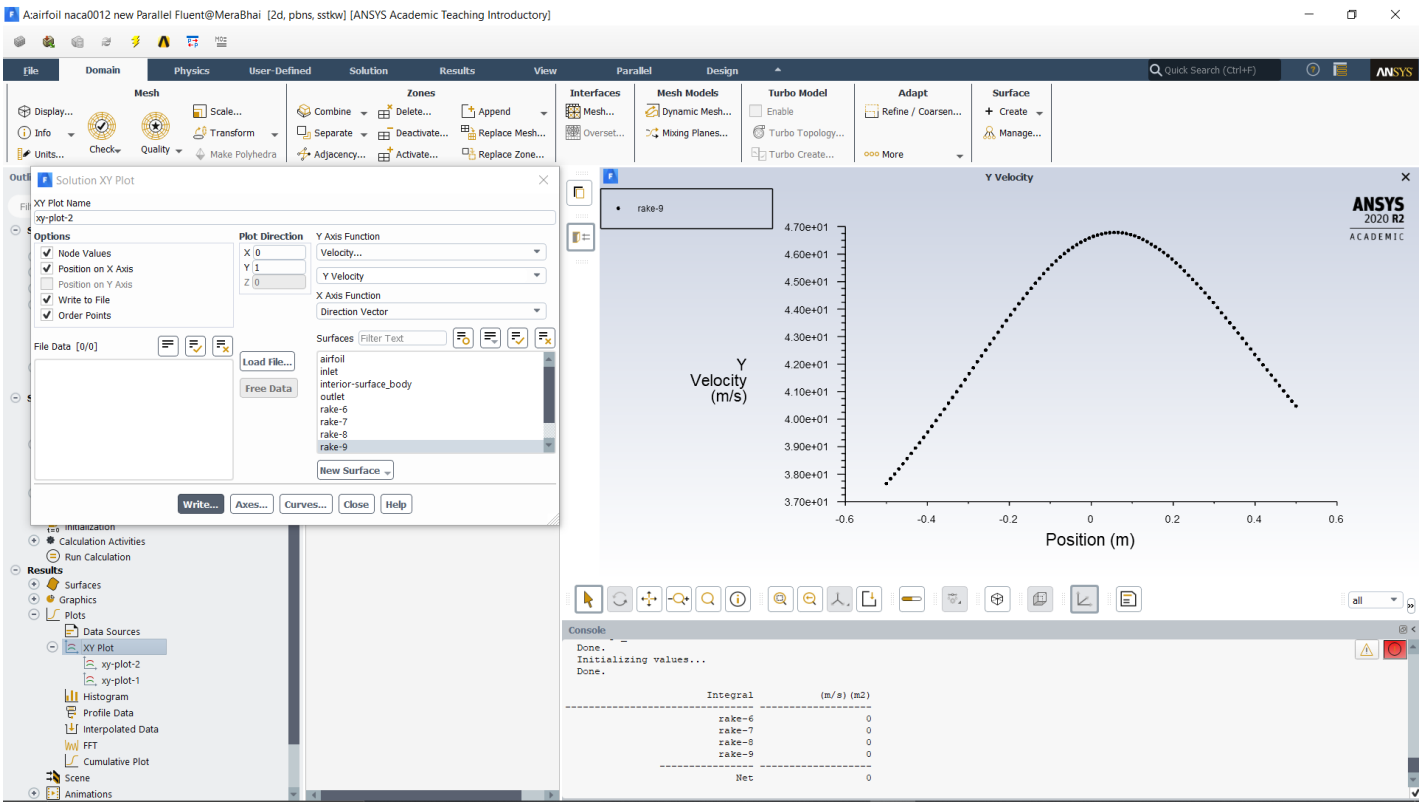
Rake-7


Solution XY Plot
XY Plot Name
xy-plot-2
Options
Node Values
Position on X Axis
Position on Y Axis
Write to File
Order Points
Plot Direction
Y Axis Function
Velocity...
Y Velocity
X Axis Function
Direction Vector
Surfaces
Filter Text
airfoil
inlet
interior-surface_body
outlet
rake-6
rake-7
rake-8
rake-9
File Data [0/0]
Load File...
Free Data
New Surface
Save/Plot
Axes...
Curves...
Close
Help
Y Velocity
rake-7
Y Velocity (m/s)
Position (m)
ANSYS 2020 R2 ACADEMIC
Console
Done.
Initializing values...
Done.
Integral (m/s) (m2)
rake-6 0
rake-7 0
rake-8 0
rake-9 0
Net 0

Rake-8


A:airfoil naca0012 new Parallel Fluent@MeraBhai [2d, pbns, sstkw] [ANSYS Academic Teaching Introductory]
Solution XY Plot
XY Plot Name
xy-plot-2
Options
Node Values
Position on X Axis
Position on Y Axis
Write to File
Order Points
Plot Direction
Y Axis Function
Velocity...
X Velocity
X Axis Function
Direction Vector
Surfaces
airfoil
inlet
interior-surface_body
outlet
rake-6
rake-7
rake-8
rake-9
Load File...
Free Data
New Surface
Save/Plot
Axes...
Curves...
Close
Help
X Velocity
rake-8
ANSYS 2020 R2 ACADEMIC
X Velocity (m/s)
Position (m)
Console
Done.
Initializing values...
Done.
Integral (m/s) (m2)
rake-6 0
rake-7 0
rake-8 0
rake-9 0
Net 0

Rake-9



For 3° angle of attack

$$\text{Circulation} = \int_A^B \boldsymbol{v}.\boldsymbol{dl} + \int_B^C \boldsymbol{v}.\boldsymbol{dl} + \int_C^D \boldsymbol{v}.\boldsymbol{dl} + \int_D^A \boldsymbol{v}.\boldsymbol{dl}$$

= 524.435 - 7.94 - 496.595 +21.37

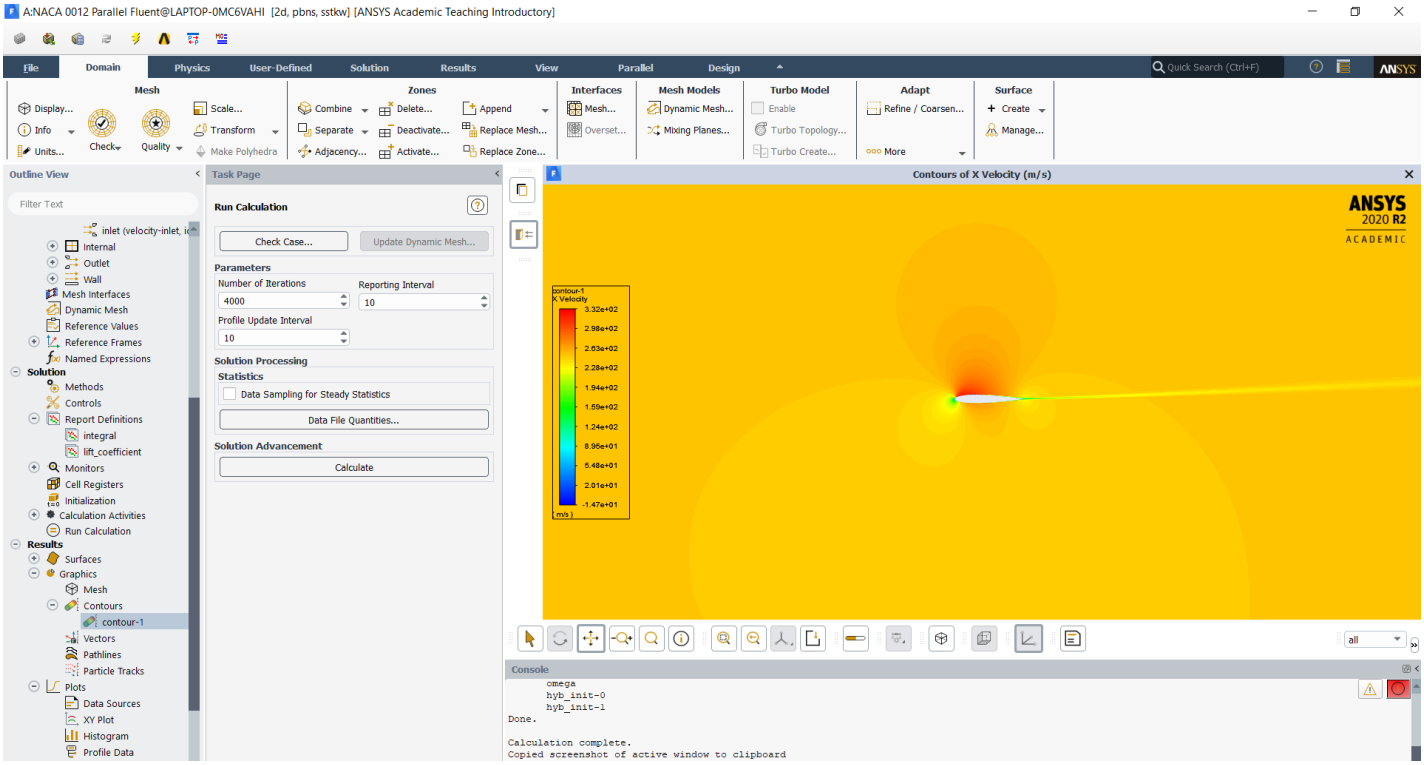
= 41.27

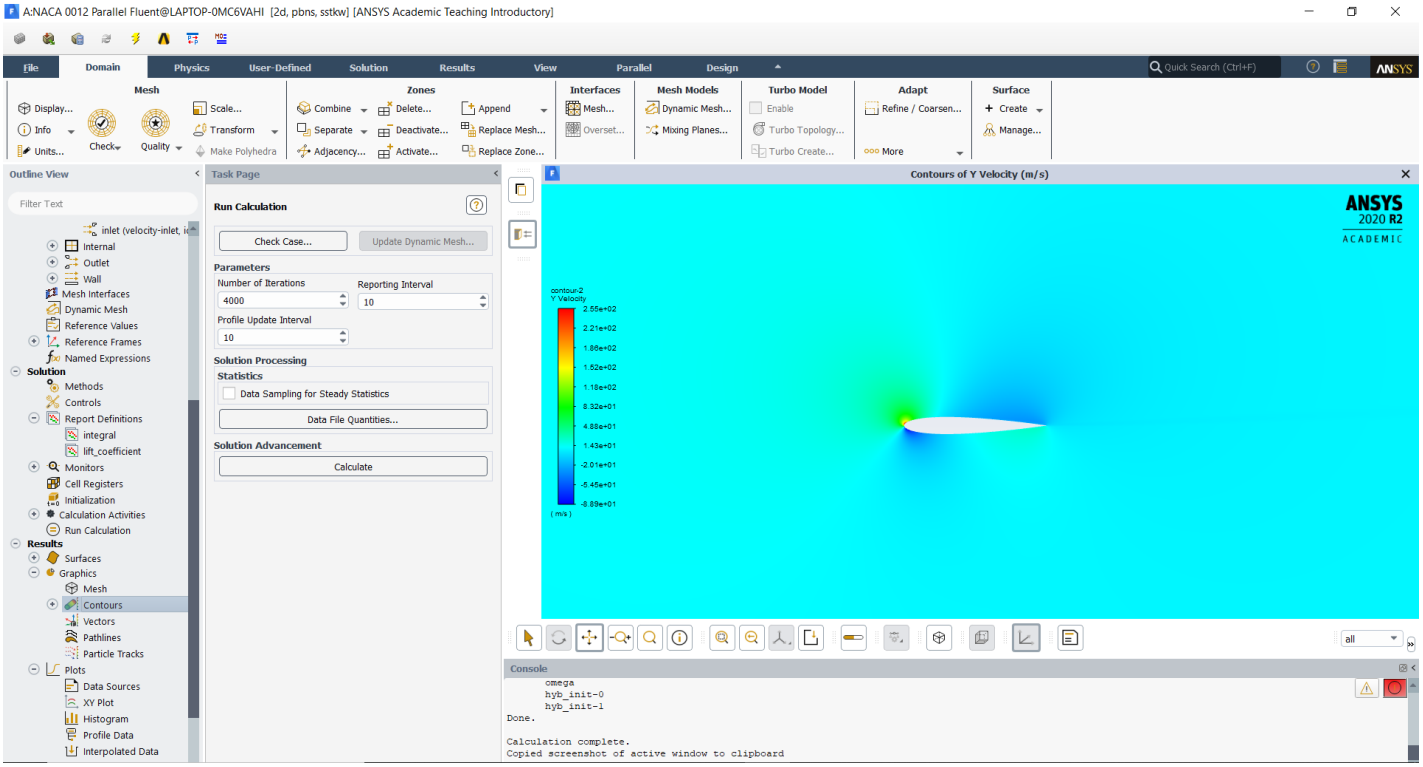
Air density = 1.225 Kg/m^3

Freestream velocity = 250m/s

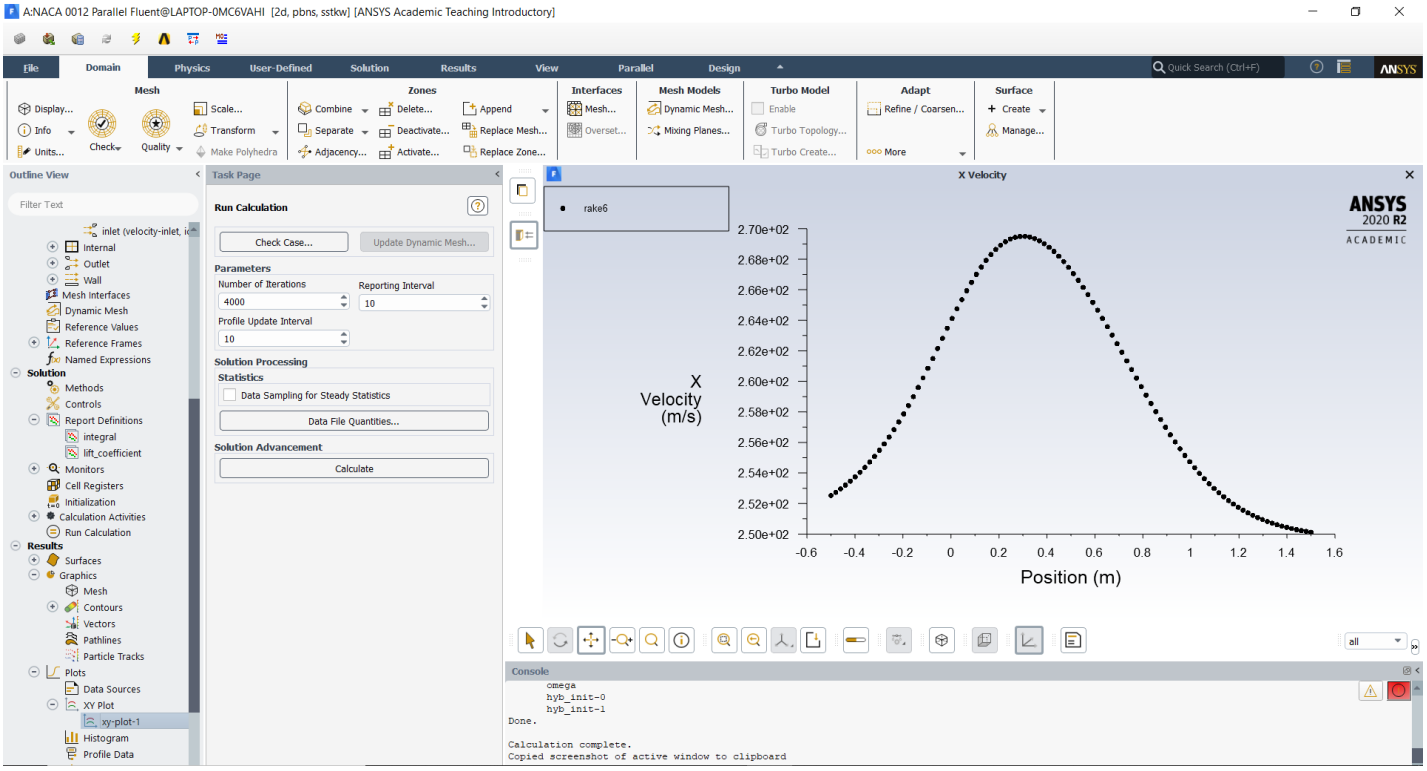
Lift = (Air density)*(Freestream velocity)*(circulation)

= 1.225*250*41.27 = 12638.94 N

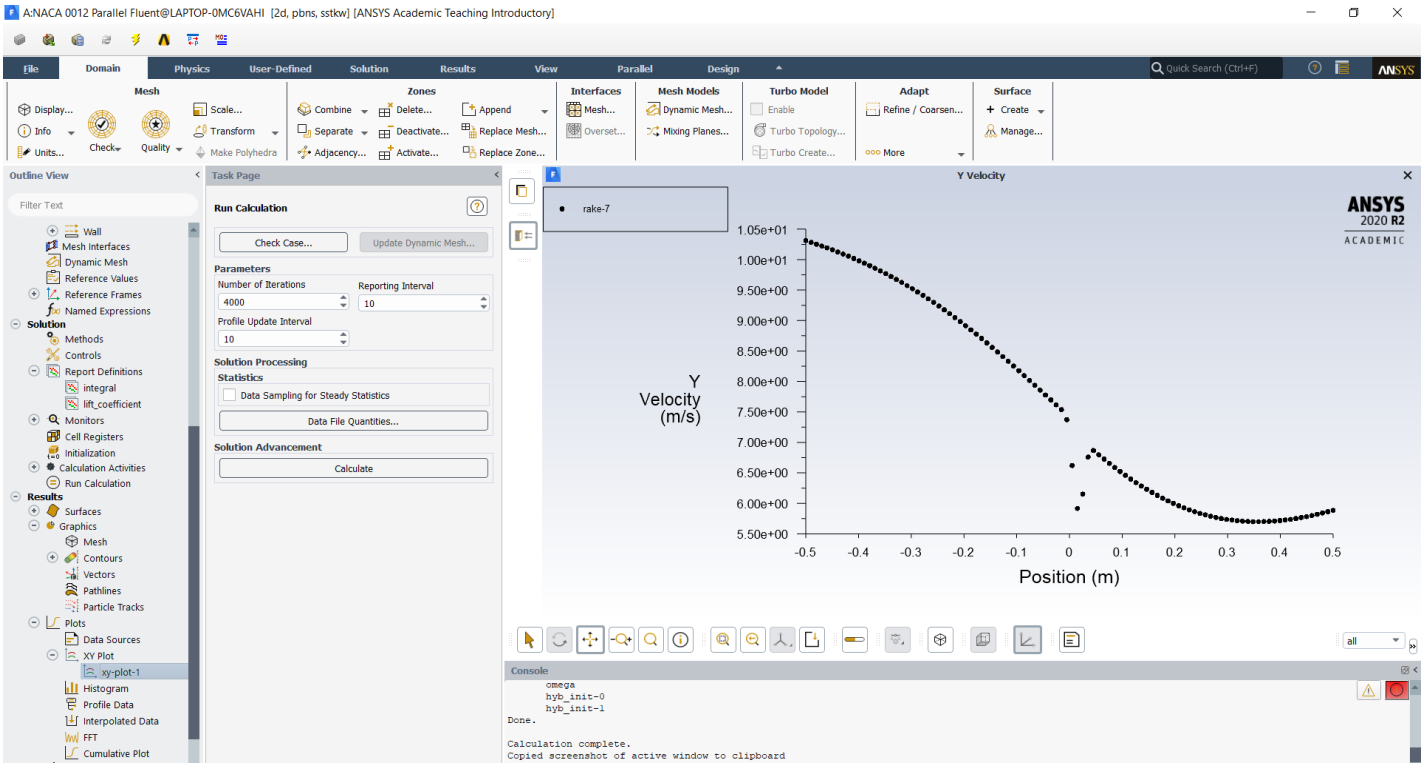

A:NACA 0012 Parallel Fluent@LAPTOP-0MC6VAHI [2d, pbns, sstkw] [ANSYS Academic Teaching Introductory]
Contours of X Velocity (m/s)
ANSYS 2020 R2 ACADEMIC
Run Calculation
Check Case...
Update Dynamic Mesh...
Number of Iterations
4000
Reporting Interval
10
Profile Update Interval
10
Data Sampling for Steady Statistics
Data File Quantities...
Calculate
Done.
Calculation complete.
Copied screenshot of active window to clipboard


A:NACA 0012 Parallel Fluent@LAPTOP-0MC6VAHI [2d, pbns, sstkw] [ANSYS Academic Teaching Introductory]
Contours of Y Velocity (m/s)
ANSYS 2020 R2 ACADEMIC
Run Calculation
Check Case...
Update Dynamic Mesh...
Number of Iterations
4000
Reporting Interval
10
Profile Update Interval
10
Data Sampling for Steady Statistics
Data File Quantities...
Calculate
Done.
Calculation complete.
Copied screenshot of active window to clipboard

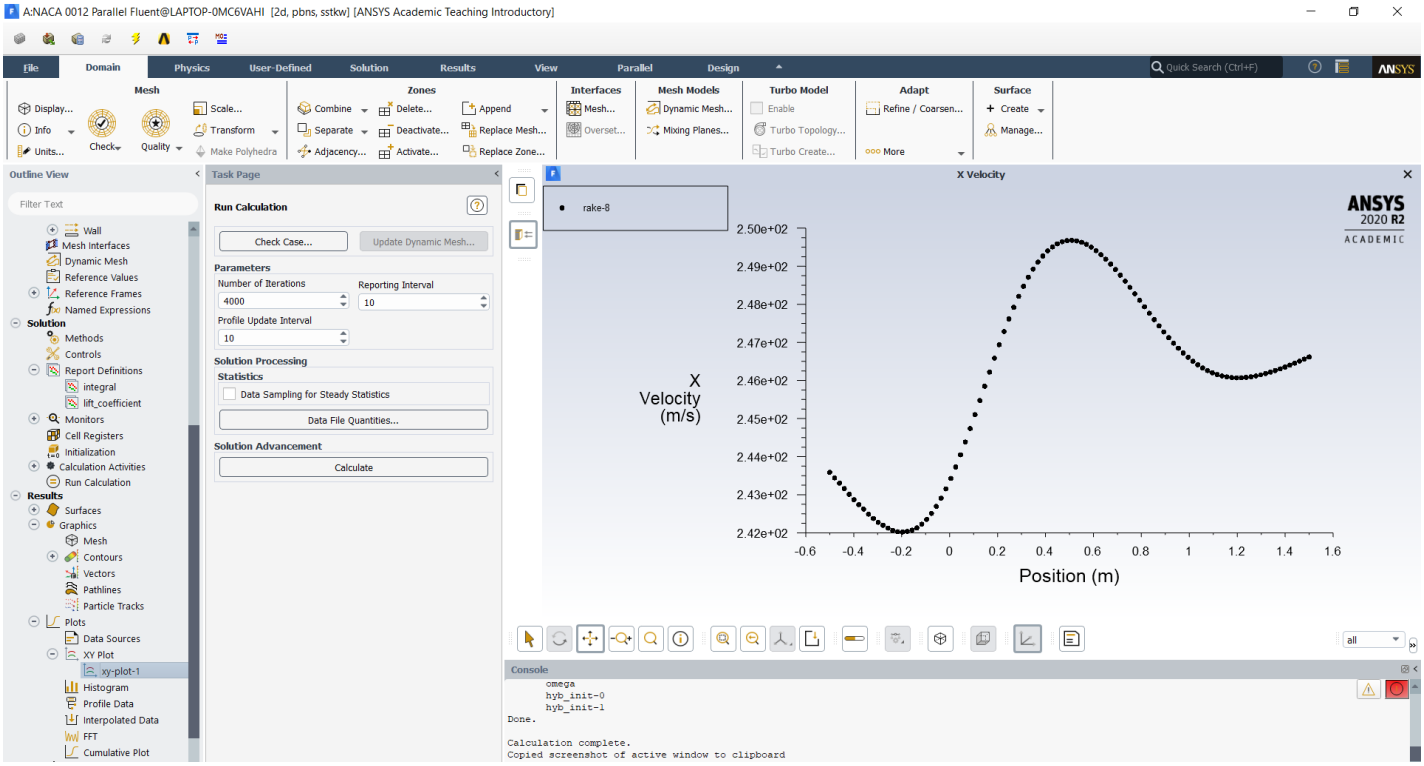
Rake-6


A:NACA 0012 Parallel Fluent@LAPTOP-0MC6VAHI [2d, pbns, sstkw] [ANSYS Academic Teaching Introductory]
File
Domain
Physics
User-Defined
Solution
Results
View
Parallel
Design
Outline View
Task Page
Run Calculation
Check Case...
Update Dynamic Mesh...
Parameters
Number of Iterations
4000
Reporting Interval
10
Profile Update Interval
10
Solution Processing
Statistics
Data Sampling for Steady Statistics
Data File Quantities...
Solution Advancement
Calculate
X Velocity
rake6
ANSYS
2020 R2
ACADEMIC
X Velocity (m/s)
Position (m)
Console
omega
hyb_init-0
hyb_init-1
Done.
Calculation complete.
Copied screenshot of active window to clipboard

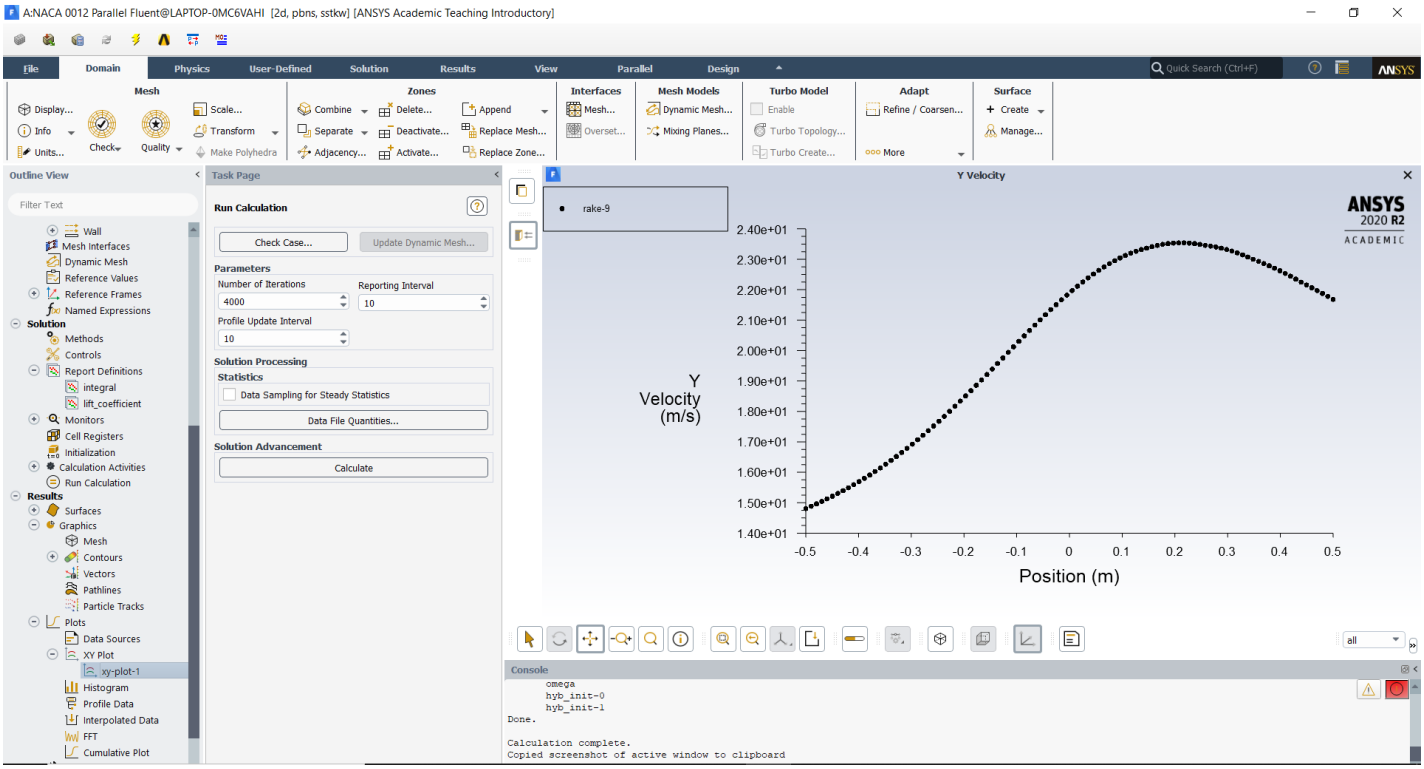
Rake-7


A:NACA 0012 Parallel Fluent@LAPTOP-0MC6VAHI [2d, pbns, sstkw] [ANSYS Academic Teaching Introductory]
File
Domain
Physics
User-Defined
Solution
Results
View
Parallel
Design
Outline View
Task Page
Run Calculation
Check Case...
Update Dynamic Mesh...
Parameters
Number of Iterations
4000
Reporting Interval
10
Profile Update Interval
10
Solution Processing
Statistics
Data Sampling for Steady Statistics
Data File Quantities...
Solution Advancement
Calculate
Y Velocity
rake-7
ANSYS
2020 R2
ACADEMIC
Y Velocity (m/s)
Position (m)
Console
omega
hyb_init-0
hyb_init-1
Done.
Calculation complete.
Copied screenshot of active window to clipboard

Rake-8


A:NACA 0012 Parallel Fluent@LAPTOP-0MC6VAHI [2d, pbns, sstkw] [ANSYS Academic Teaching Introductory]
File
Domain
Physics
User-Defined
Solution
Results
View
Parallel
Design
Outline View
Task Page
Run Calculation
Check Case...
Update Dynamic Mesh...
Parameters
Number of Iterations
4000
Reporting Interval
10
Profile Update Interval
10
Solution Processing
Statistics
Data Sampling for Steady Statistics
Data File Quantities...
Solution Advancement
Calculate
X Velocity
rake-8
X Velocity (m/s)
Position (m)
ANSYS 2020 R2 ACADEMIC
Console
Done.
Calculation complete.
Copied screenshot of active window to clipboard

Rake-9


A:NACA 0012 Parallel Fluent@LAPTOP-0MC6VAHI [2d, pbns, sstkw] [ANSYS Academic Teaching Introductory]
File
Domain
Physics
User-Defined
Solution
Results
View
Parallel
Design
Outline View
Task Page
Run Calculation
Check Case...
Update Dynamic Mesh...
Parameters
Number of Iterations
4000
Reporting Interval
10
Profile Update Interval
10
Solution Processing
Statistics
Data Sampling for Steady Statistics
Data File Quantities...
Solution Advancement
Calculate
Y Velocity
rake-9
Y Velocity (m/s)
Position (m)
ANSYS 2020 R2 ACADEMIC
Console
Done.
Calculation complete.
Copied screenshot of active window to clipboard

NACA 4412 Cambered Airfoil

For 0° angle of attack

$$\text{Circulation} = \int_A^B \boldsymbol{v}.\boldsymbol{dl} + \int_B^C \boldsymbol{v}.\boldsymbol{dl} + \int_C^D \boldsymbol{v}.\boldsymbol{dl} + \int_D^A \boldsymbol{v}.\boldsymbol{dl}$$

= 530.51 - (-8.18) - 493.07 + 8

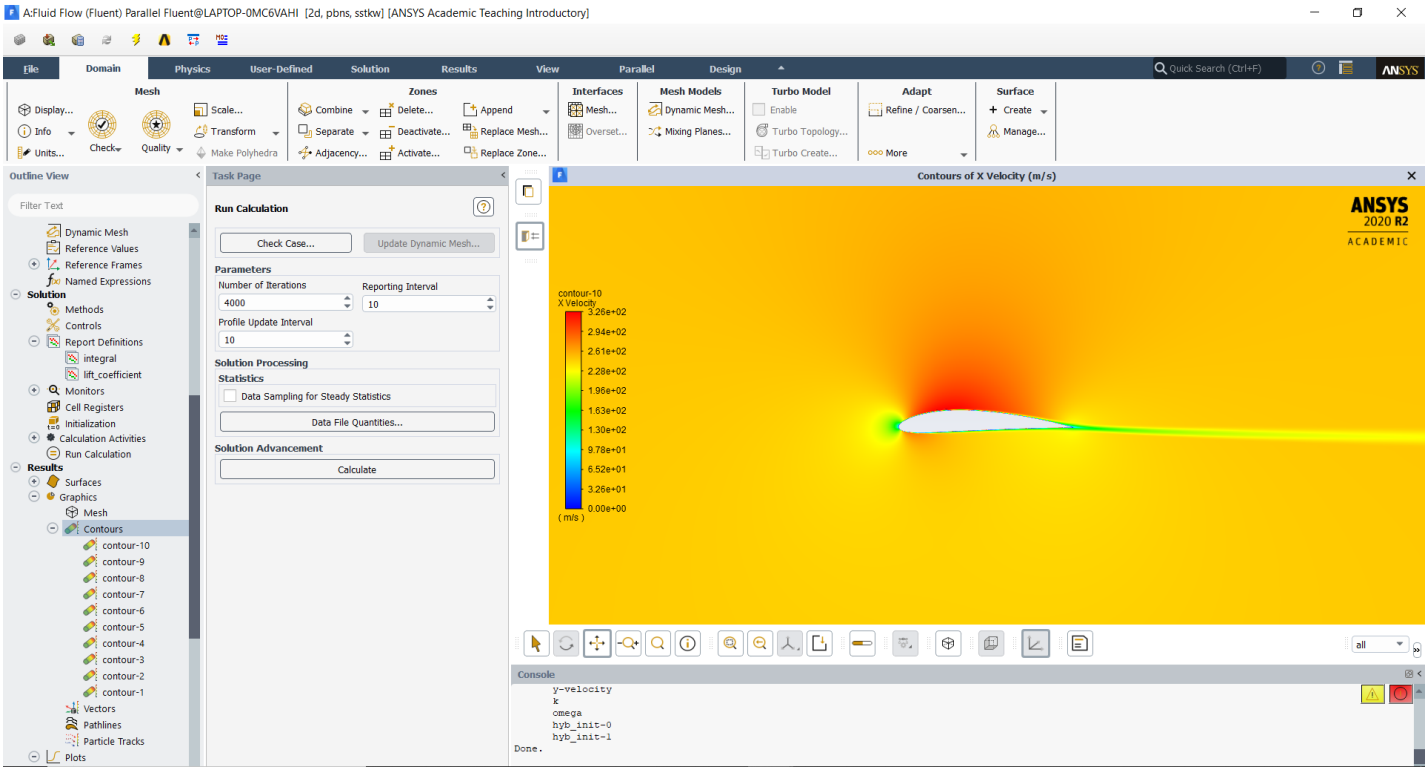
= 53.62

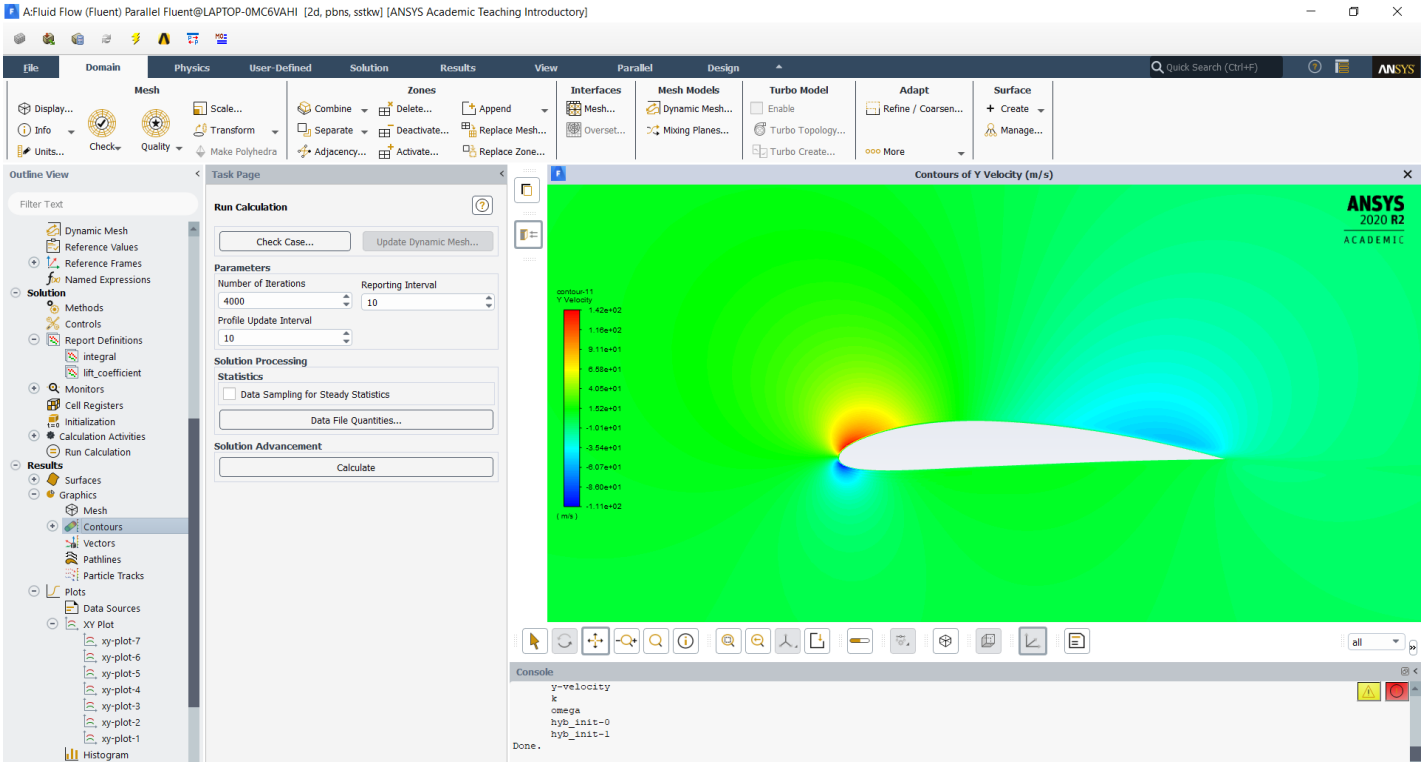
Air density = 1.225 Kg/m^3

Freestream velocity = 250m/s

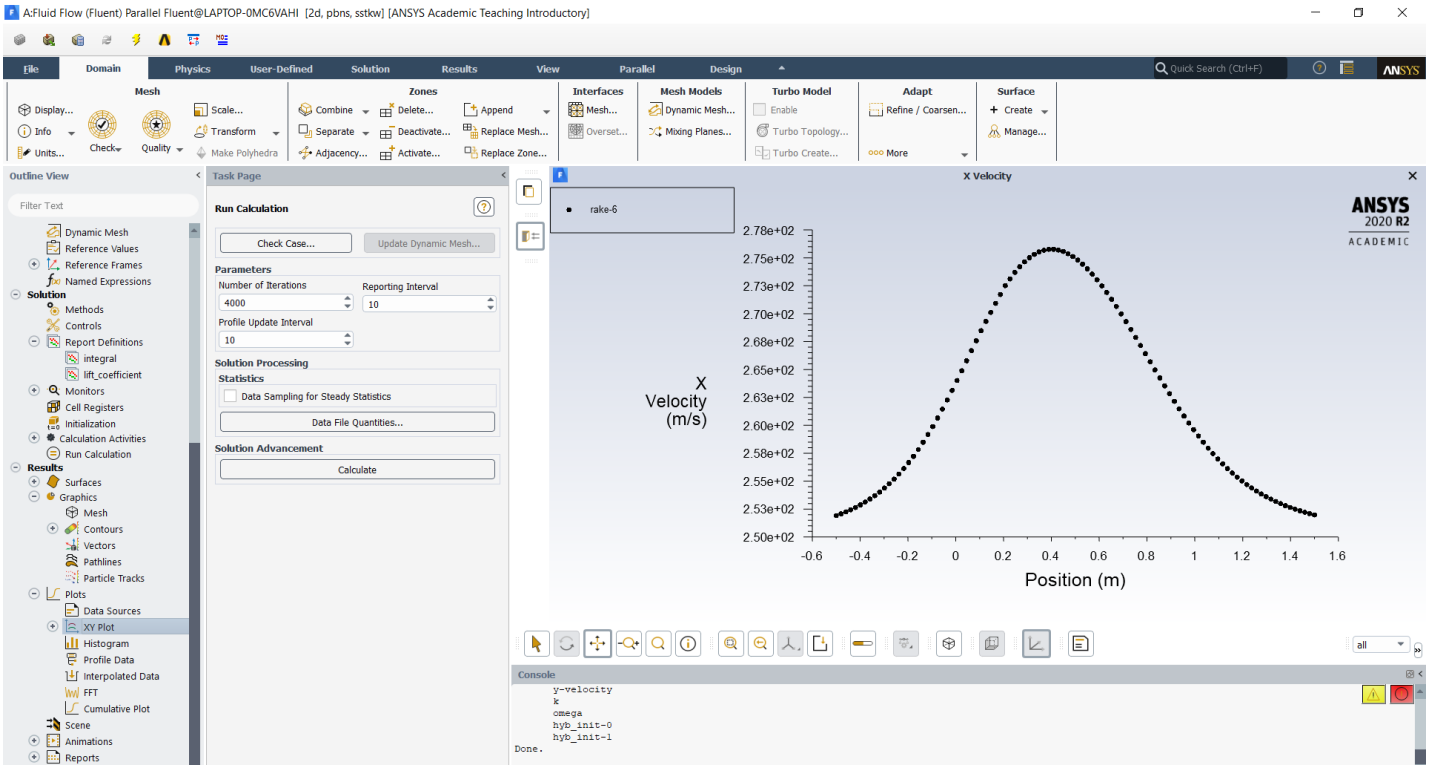
Lift = (Air density)*(Freestream velocity)*(circulation)

= 1.225*250*53.62 = 16421.125 N

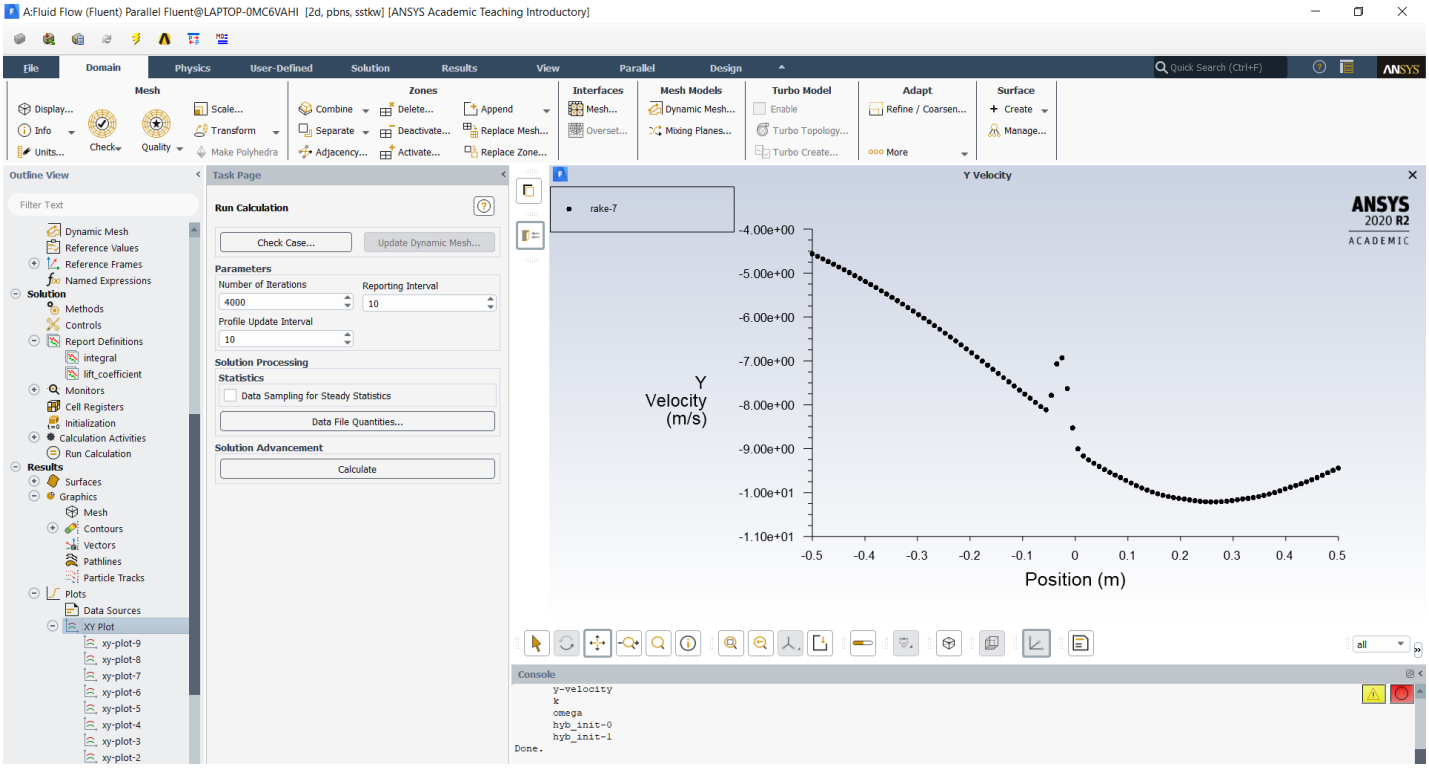



A:Fluid Flow (Fluent) Parallel Fluent@LAPTOP-0MC6VAHI [2d, pbns, sstkw] [ANSYS Academic Teaching Introductory]
File
Domain
Physics
User-Defined
Solution
Results
View
Parallel
Design
Mesh
Zones
Interfaces
Mesh Models
Turbo Model
Adapt
Surface
Outline View
Task Page
Run Calculation
Check Case...
Update Dynamic Mesh...
Parameters
Number of Iterations
4000
Reporting Interval
10
Profile Update Interval
10
Solution Processing
Statistics
Data Sampling for Steady Statistics
Data File Quantities...
Solution Advancement
Calculate
Contours of Y Velocity (m/s)
ANSYS
2020 R2
ACADEMIC
Console
y-velocity
k
omega
hyb_init-0
hyb_init-1
Done.

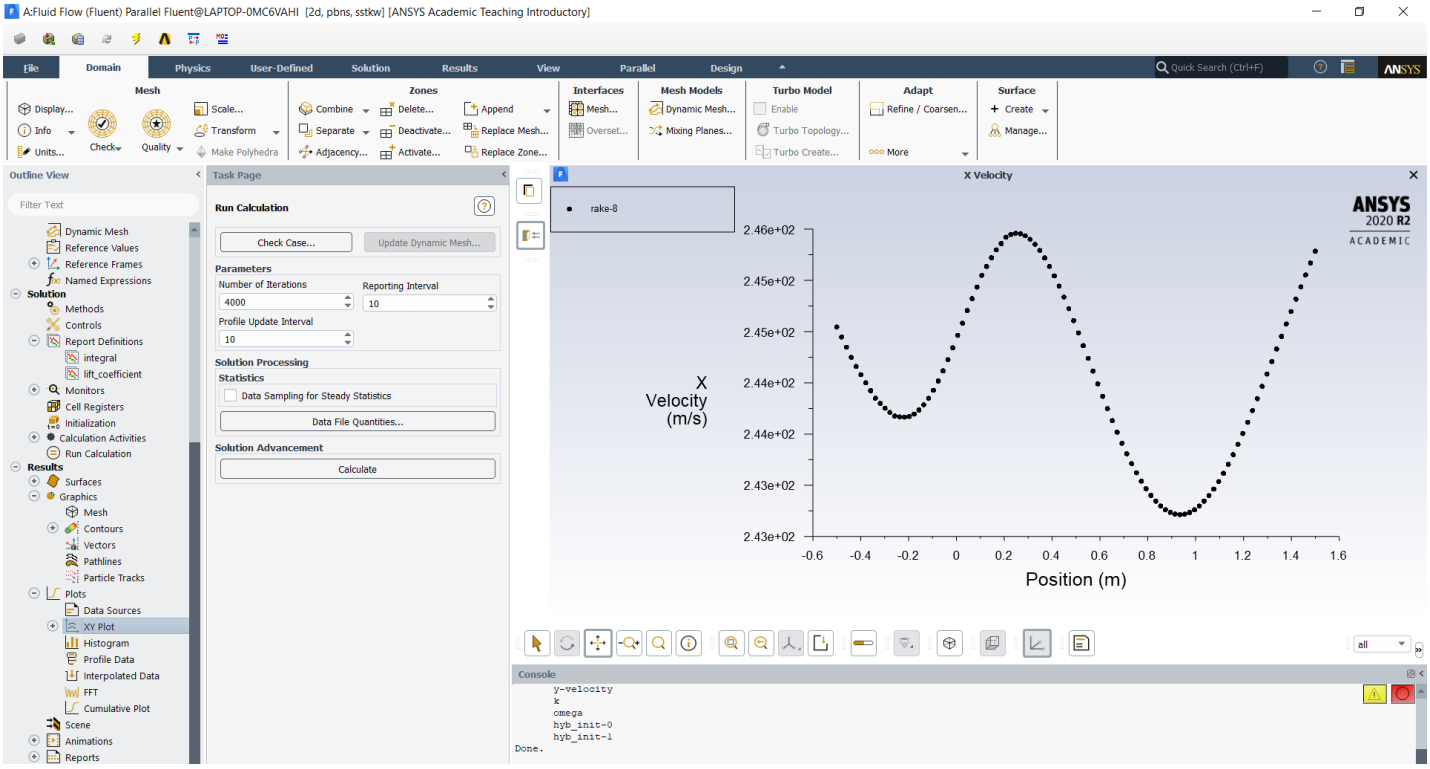
Rake-6


A:Fluid Flow (Fluent) Parallel Fluent@LAPTOP-0MC6VAHI [2d, pbns, sstkw] [ANSYS Academic Teaching Introductory]
File
Domain
Physics
User-Defined
Solution
Results
View
Parallel
Design
Outline View
Task Page
Run Calculation
Check Case...
Update Dynamic Mesh...
Parameters
Number of Iterations
4000
Reporting Interval
10
Profile Update Interval
10
Solution Processing
Statistics
Data Sampling for Steady Statistics
Data File Quantities...
Solution Advancement
Calculate
X Velocity
rake-6
X Velocity (m/s)
Position (m)
ANSYS
2020 R2
ACADEMIC
Console
y-velocity
k
omega
hyb_init-0
hyb_init-1
Done.

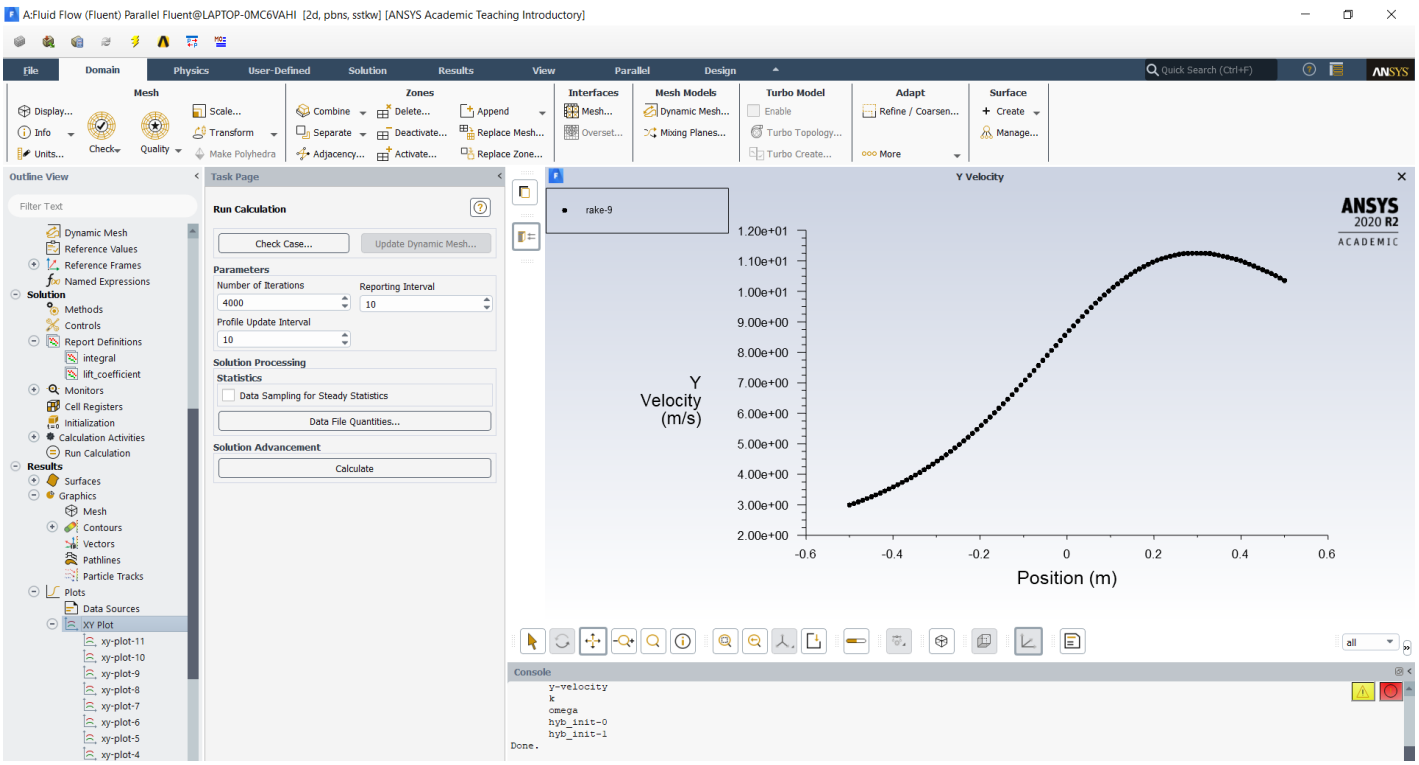
Rake-7


A:Fluid Flow (Fluent) Parallel Fluent@LAPTOP-0MC6VAHI [2d, pbns, sstkw] [ANSYS Academic Teaching Introductory]
Y Velocity
rake-7
ANSYS 2020 R2 ACADEMIC
Y Velocity (m/s)
Position (m)
Run Calculation
Check Case...
Update Dynamic Mesh...
Number of Iterations
4000
Reporting Interval
10
Profile Update Interval
10
Data Sampling for Steady Statistics
Data File Quantities...
Calculate
Console
y-velocity
k
omega
hyb_init-0
hyb_init-1
Done.

Rake-8


A:Fluid Flow (Fluent) Parallel Fluent@LAPTOP-0MC6VAHI [2d, pbns, sstkw] [ANSYS Academic Teaching Introductory]
X Velocity
rake-8
ANSYS 2020 R2 ACADEMIC
X Velocity (m/s)
Position (m)
Run Calculation
Check Case...
Update Dynamic Mesh...
Number of Iterations
4000
Reporting Interval
10
Profile Update Interval
10
Data Sampling for Steady Statistics
Data File Quantities...
Calculate
Console
y-velocity
k
omega
hyb_init-0
hyb_init-1
Done.

Rake-9



For 3° angle of attack

$$\text{Circulation} = \int_A^B \boldsymbol{v}.\boldsymbol{dl} + \int_B^C \boldsymbol{v}.\boldsymbol{dl} + \int_C^D \boldsymbol{v}.\boldsymbol{dl} + \int_D^A \boldsymbol{v}.\boldsymbol{dl}$$

= 541.85 - 0.7 - 480.83 + 28.27

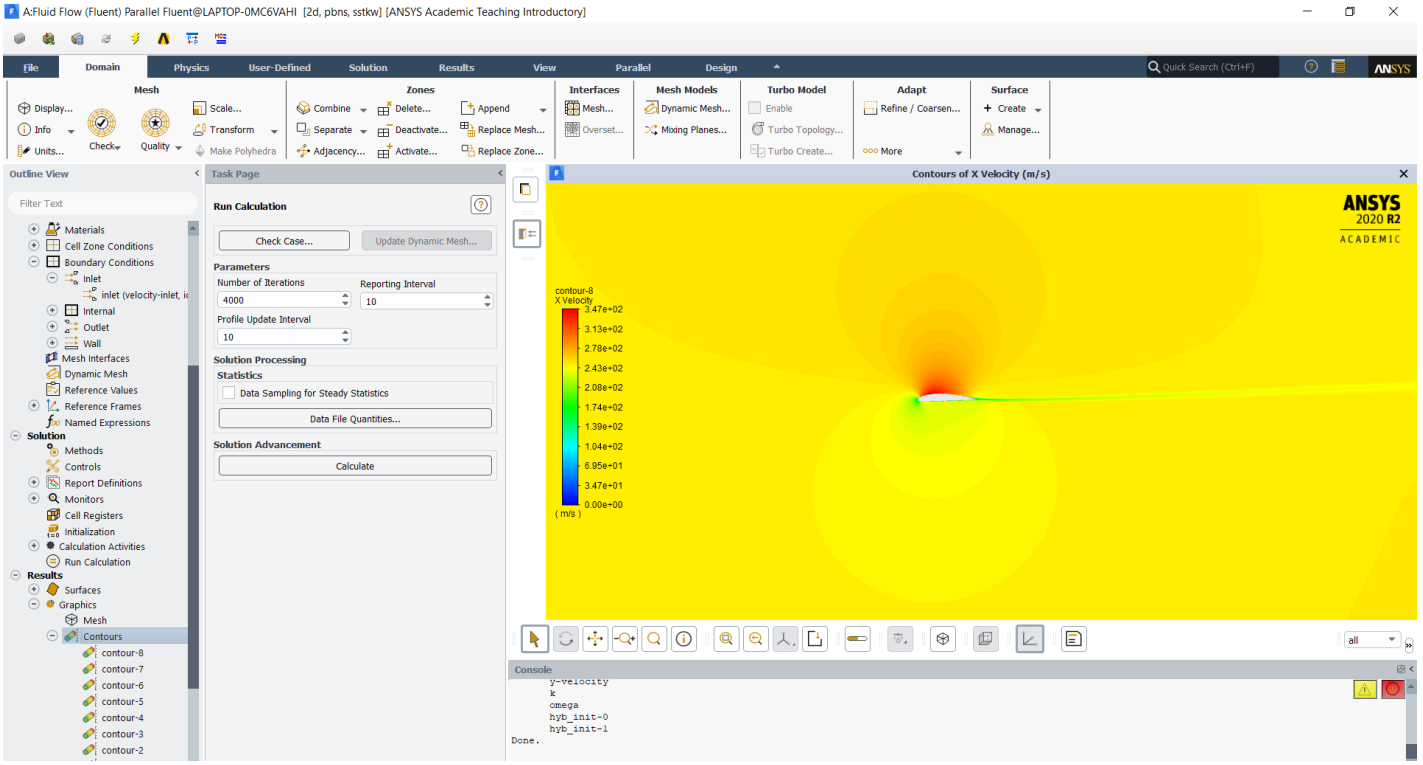
= 88.59

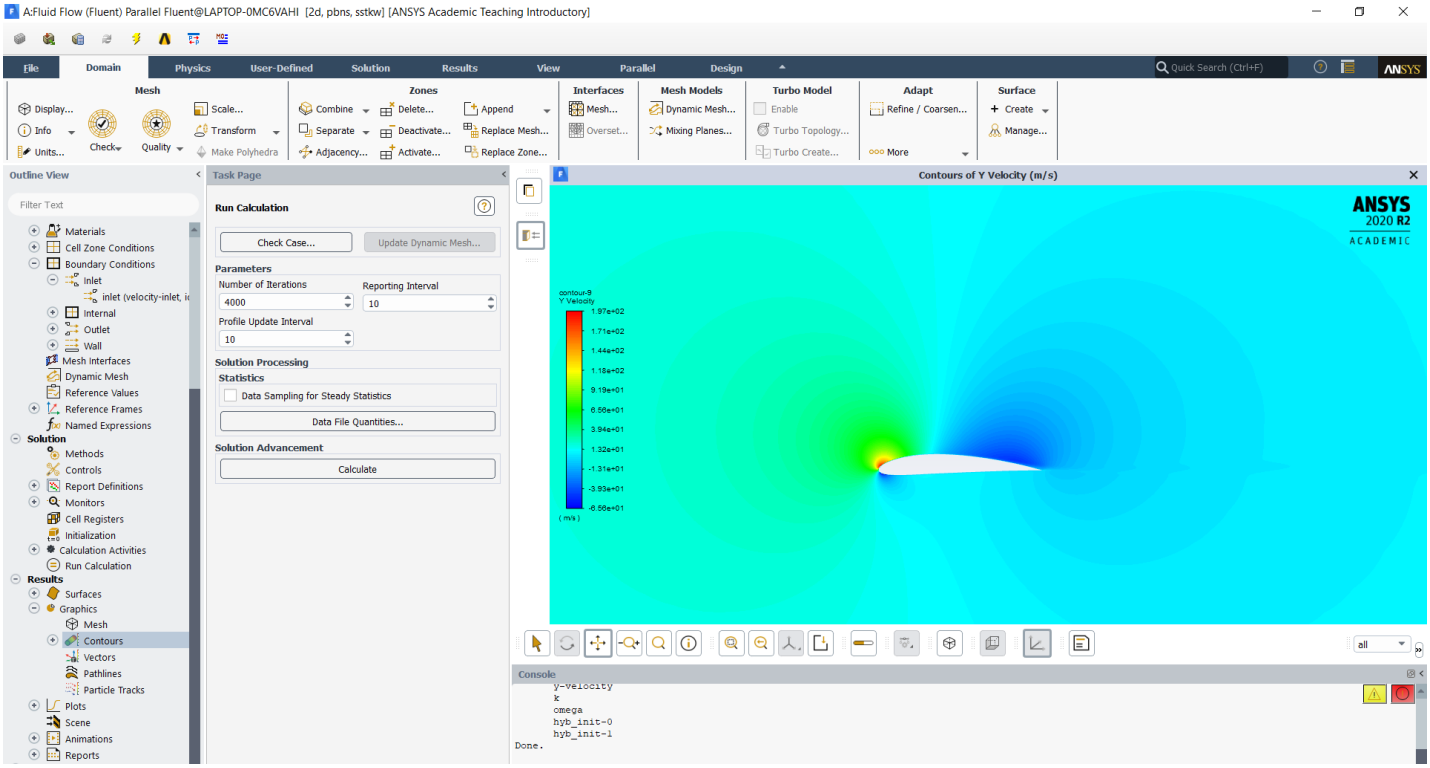
Air density = 1.225 Kg/m^3

Freestream velocity = 250m/s

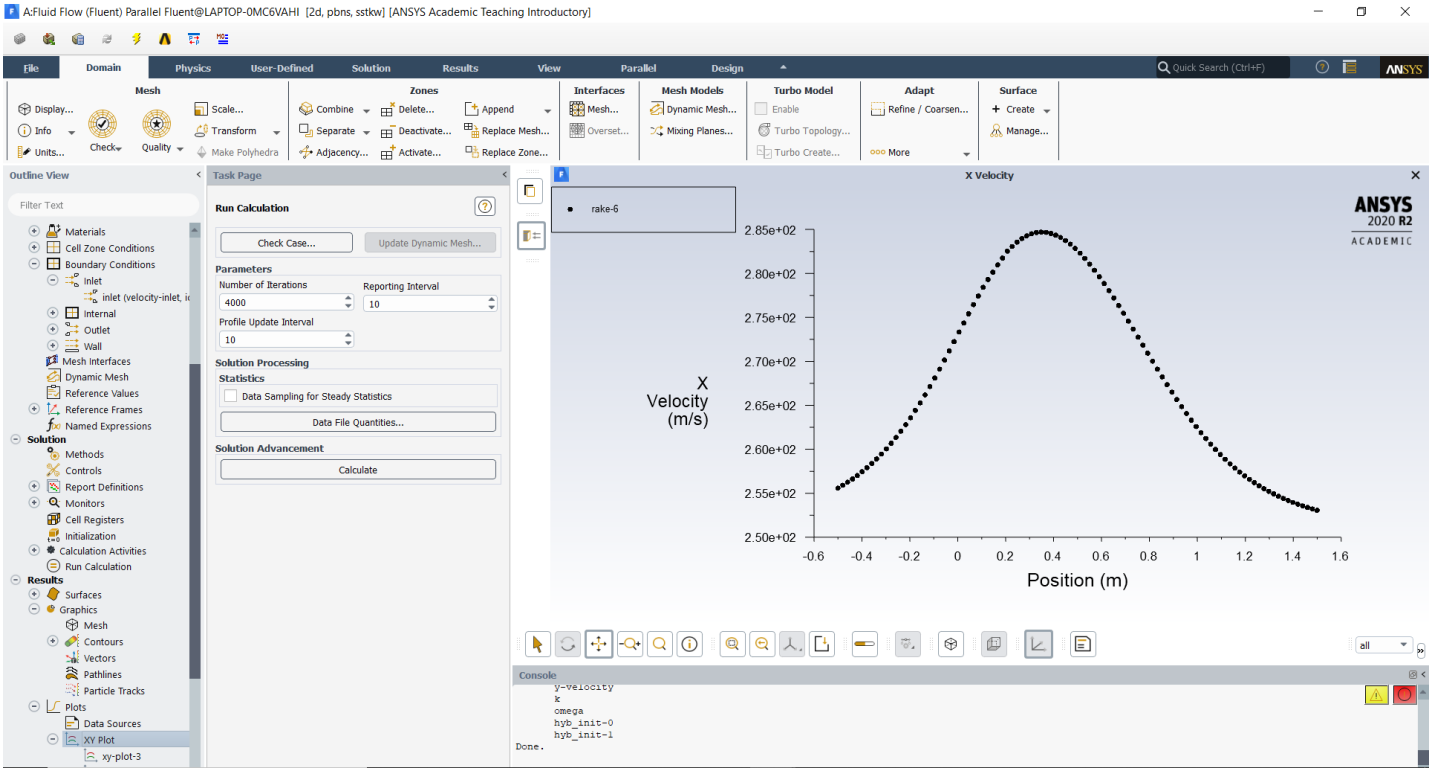
Lift = (Air density)*(Freestream velocity)*(circulation)

= 1.225*250*88.59 = 27130.69 N

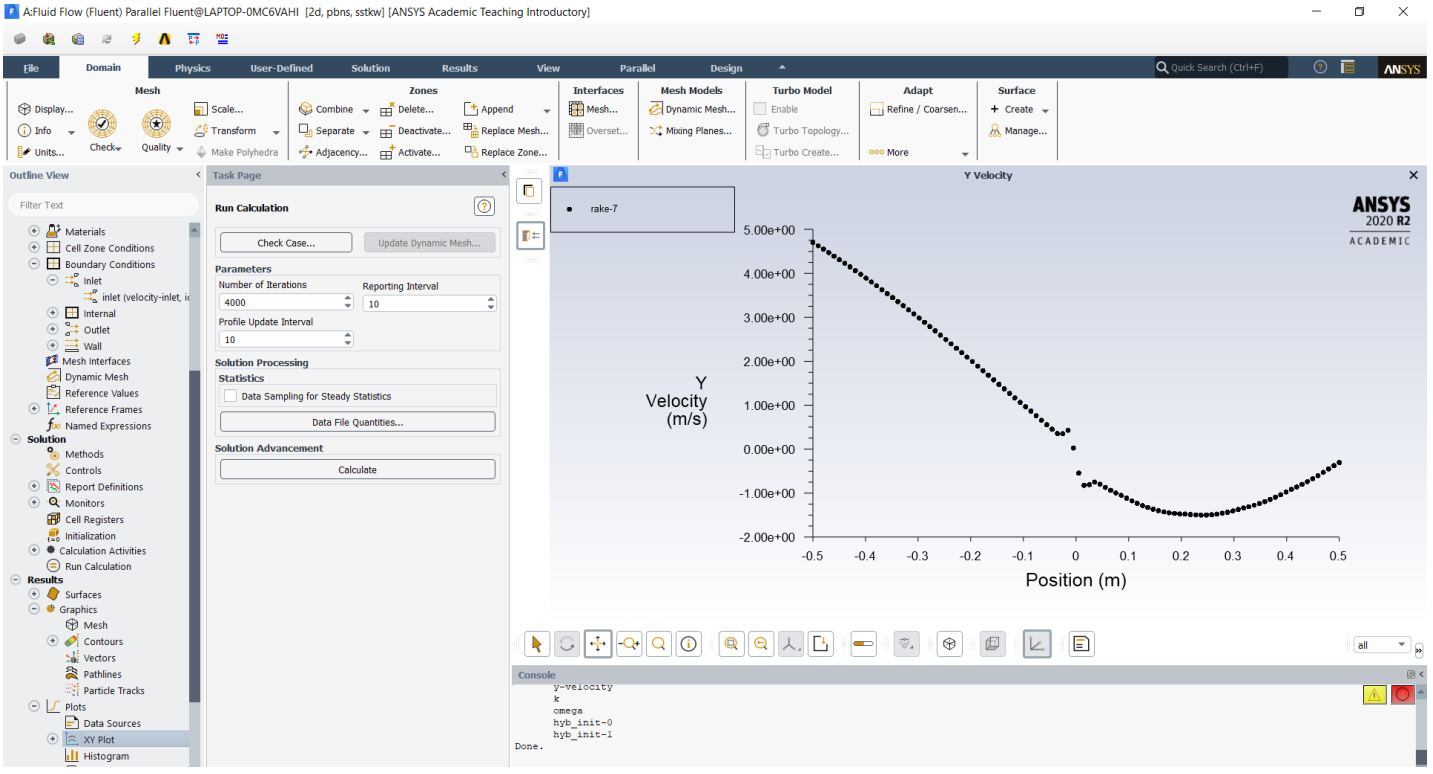

A:Fluid Flow (Fluent) Parallel Fluent@LAPTOP-0MC6VAHI [2d, pbns, sstkw] [ANSYS Academic Teaching Introductory]
File
Domain
Physics
User-Defined
Solution
Results
View
Parallel
Design
Mesh
Zones
Interfaces
Mesh Models
Turbo Model
Adapt
Surface
Outline View
Task Page
Run Calculation
Check Case...
Update Dynamic Mesh...
Parameters
Number of Iterations
4000
Reporting Interval
10
Profile Update Interval
10
Solution Processing
Statistics
Data Sampling for Steady Statistics
Data File Quantities...
Solution Advancement
Calculate
Contours of X Velocity (m/s)
ANSYS
2020 R2
ACADEMIC
contour-8
X Velocity
3.47e+02
3.13e+02
2.78e+02
2.43e+02
2.08e+02
1.74e+02
1.39e+02
1.04e+02
6.95e+01
3.47e+01
0.00e+00
(m/s)
Console
y-velocity
k
omega
hyb_init-0
hyb_init-1
Done.


A:Fluid Flow (Fluent) Parallel Fluent@LAPTOP-0MC6VAHI [2d, pbns, sstkw] [ANSYS Academic Teaching Introductory]
File
Domain
Physics
User-Defined
Solution
Results
View
Parallel
Design
Mesh
Zones
Interfaces
Mesh Models
Turbo Model
Adapt
Surface
Outline View
Task Page
Run Calculation
Check Case...
Update Dynamic Mesh...
Parameters
Number of Iterations
4000
Reporting Interval
10
Profile Update Interval
10
Solution Processing
Statistics
Data Sampling for Steady Statistics
Data File Quantities...
Solution Advancement
Calculate
Contours of Y Velocity (m/s)
ANSYS
2020 R2
ACADEMIC
contour-9
Y Velocity
1.97e+02
1.71e+02
1.44e+02
1.18e+02
9.19e+01
6.56e+01
3.94e+01
1.32e+01
-1.31e+01
-3.93e+01
-6.56e+01
(m/s)
Console
y-velocity
k
omega
hyb_init-0
hyb_init-1
Done.

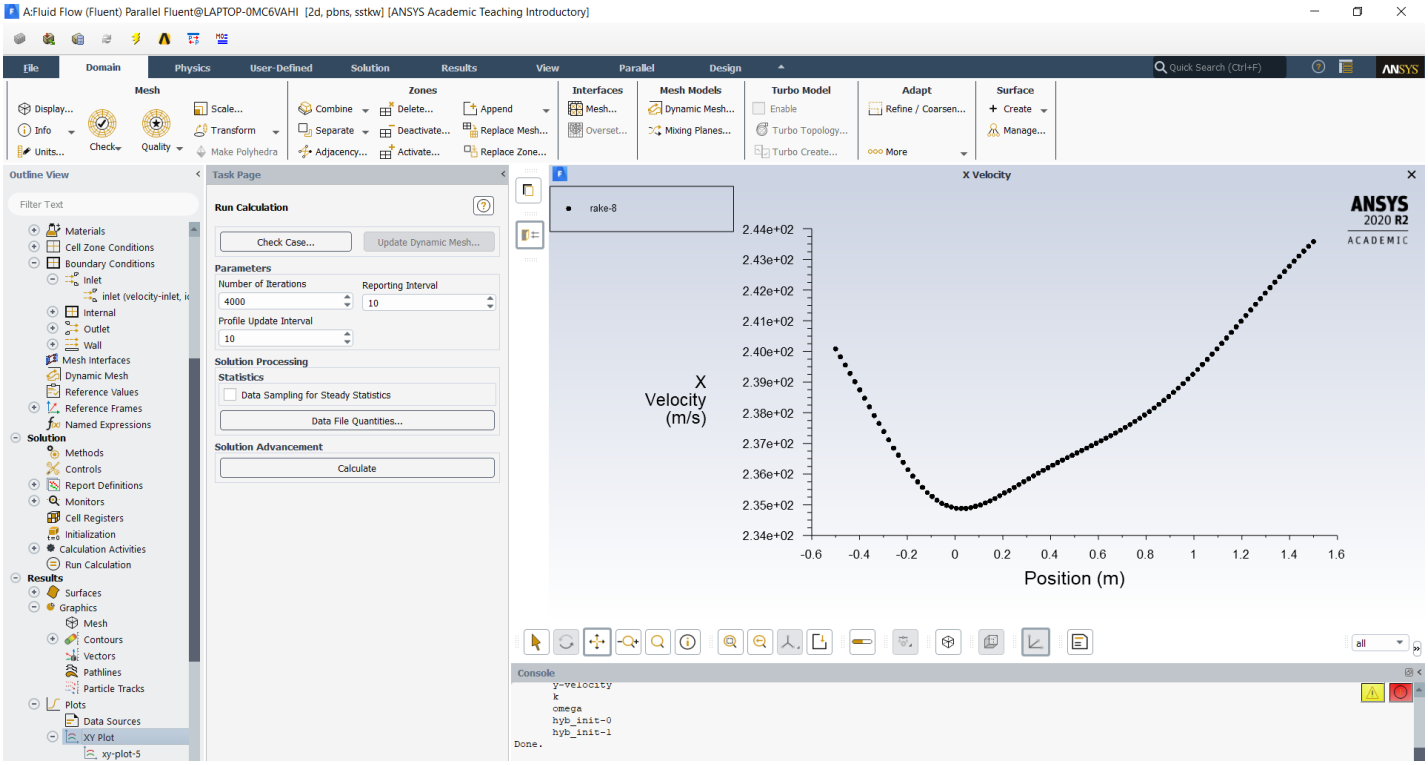
Rake-6


A:Fluid Flow (Fluent) Parallel Fluent@LAPTOP-0MC6VAHI [2d, pbns, sstkw] [ANSYS Academic Teaching Introductory]
File
Domain
Physics
User-Defined
Solution
Results
View
Parallel
Design
Outline View
Task Page
Run Calculation
Check Case...
Update Dynamic Mesh...
Parameters
Number of Iterations
4000
Reporting Interval
10
Profile Update Interval
10
Solution Processing
Statistics
Data Sampling for Steady Statistics
Data File Quantities...
Solution Advancement
Calculate
X Velocity
rake-6
ANSYS
2020 R2
ACADEMIC
X Velocity (m/s)
Position (m)
Console
Done.

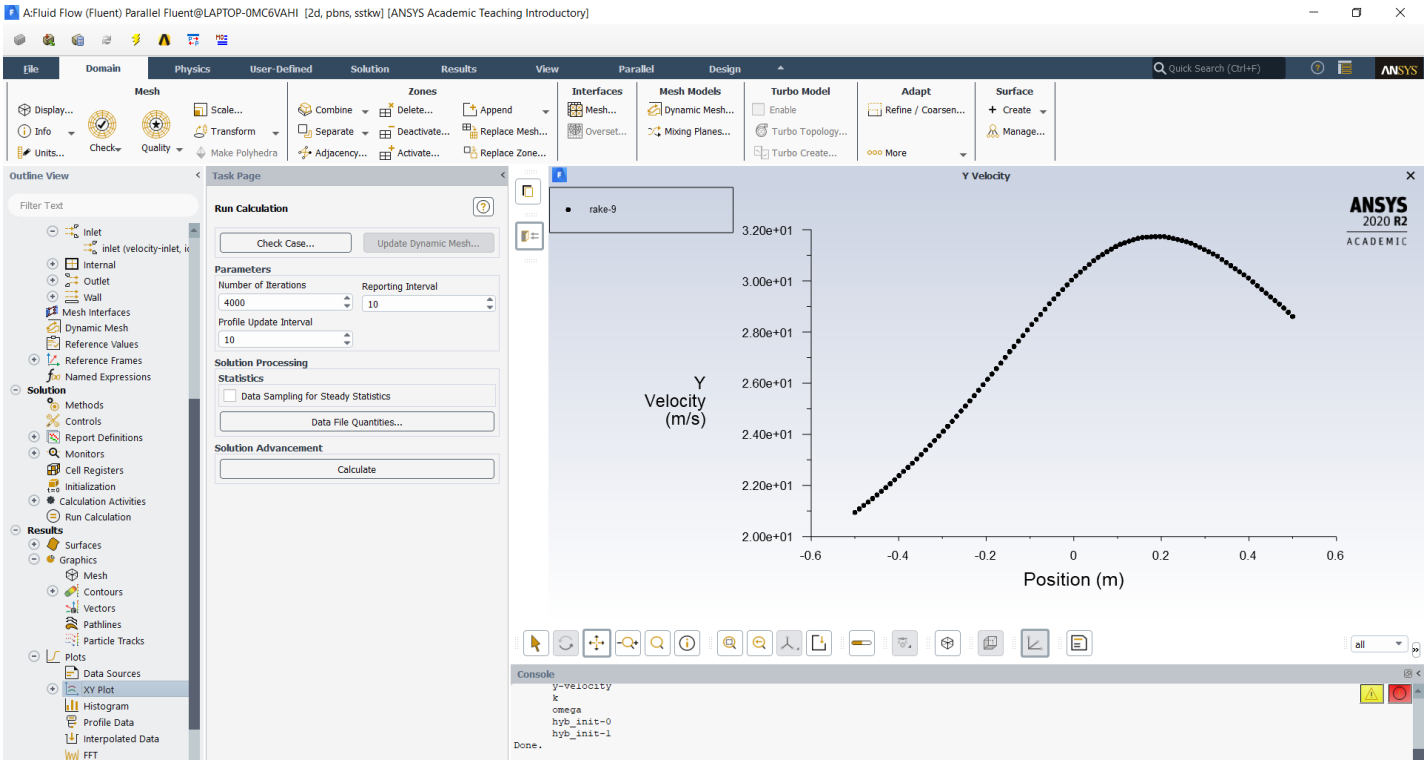
Rake-7


A:Fluid Flow (Fluent) Parallel Fluent@LAPTOP-0MC6VAHI [2d, pbns, sstkw] [ANSYS Academic Teaching Introductory]
File
Domain
Physics
User-Defined
Solution
Results
View
Parallel
Design
Outline View
Task Page
Run Calculation
Check Case...
Update Dynamic Mesh...
Parameters
Number of Iterations
4000
Reporting Interval
10
Profile Update Interval
10
Solution Processing
Statistics
Data Sampling for Steady Statistics
Data File Quantities...
Solution Advancement
Calculate
Y Velocity
rake-7
ANSYS
2020 R2
ACADEMIC
Y Velocity (m/s)
Position (m)
Console
Done.

Rake-8


A:Fluid Flow (Fluent) Parallel Fluent@LAPTOP-0MC6VAHI [2d, pbns, sstkw] [ANSYS Academic Teaching Introductory]
File
Domain
Physics
User-Defined
Solution
Results
View
Parallel
Design
Outline View
Task Page
Run Calculation
Check Case...
Update Dynamic Mesh...
Parameters
Number of Iterations
4000
Reporting Interval
10
Profile Update Interval
10
Solution Processing
Statistics
Data Sampling for Steady Statistics
Data File Quantities...
Solution Advancement
Calculate
X Velocity
rake-8
ANSYS
2020 R2
ACADEMIC
X Velocity (m/s)
Position (m)
Console
Done.

Rake-9


A:Fluid Flow (Fluent) Parallel Fluent@LAPTOP-0MC6VAHI [2d, pbns, sstkw] [ANSYS Academic Teaching Introductory]
File
Domain
Physics
User-Defined
Solution
Results
View
Parallel
Design
Outline View
Task Page
Run Calculation
Check Case...
Update Dynamic Mesh...
Parameters
Number of Iterations
4000
Reporting Interval
10
Profile Update Interval
10
Solution Processing
Statistics
Data Sampling for Steady Statistics
Data File Quantities...
Solution Advancement
Calculate
Y Velocity
rake-9
ANSYS
2020 R2
ACADEMIC
Y Velocity (m/s)
Position (m)
Console
Done.