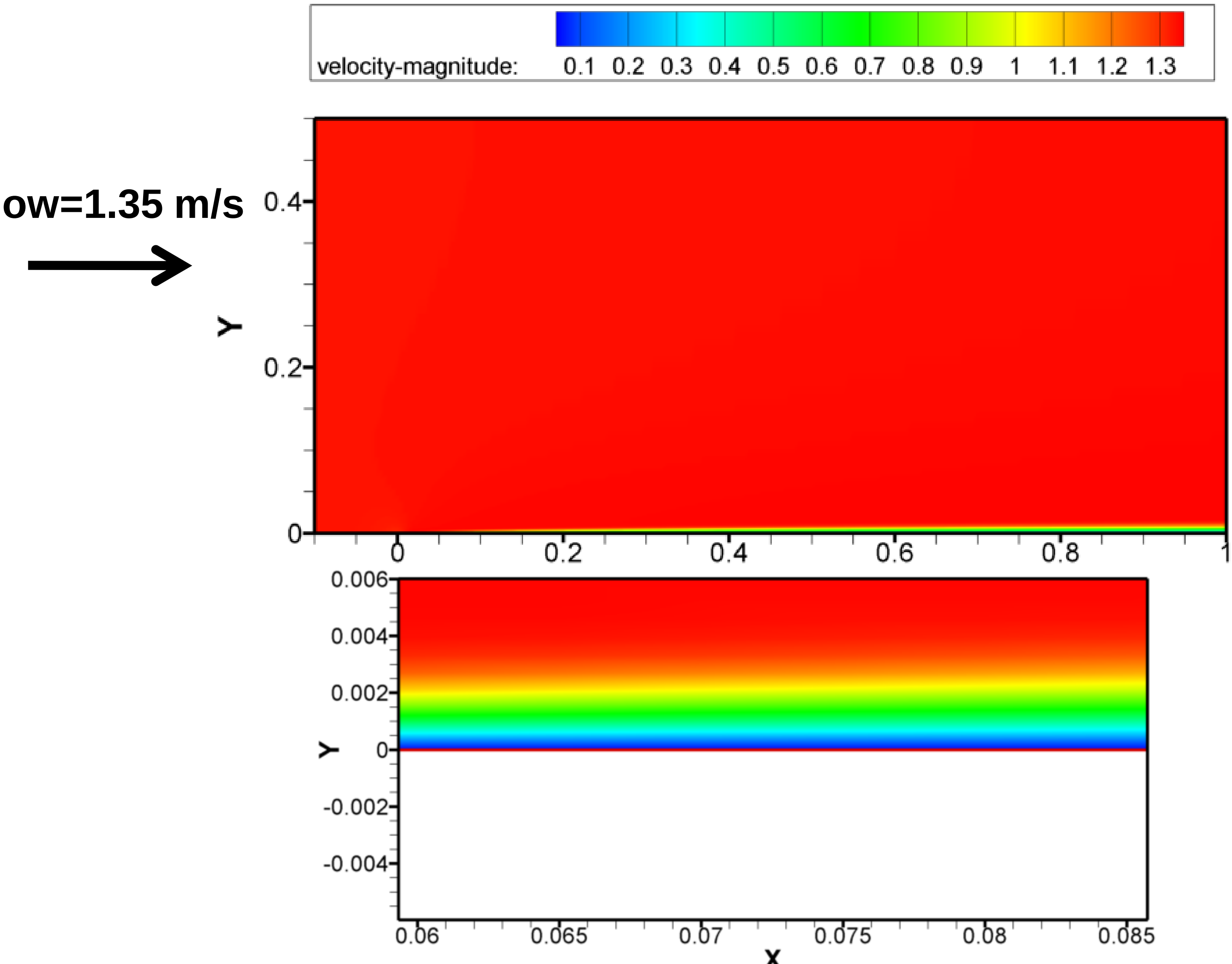
CE358/CE380T – Fall 2015

(Kinnas)

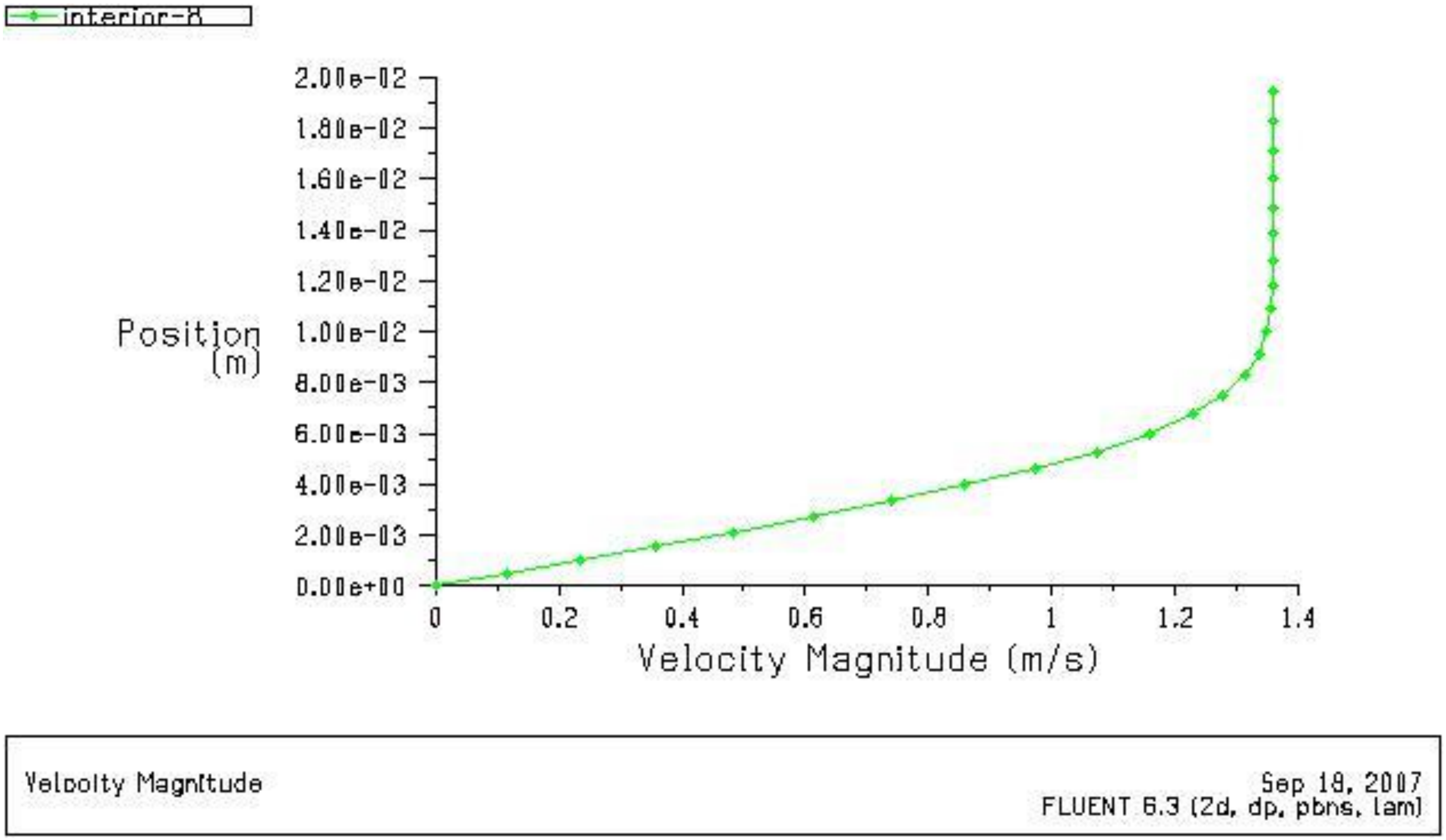
The following slides have been produced from running ANSYS_Fluent (a commercial software package) and help you understand the concepts of flow velocity, boundary layer, and vorticity

Flow over flat plate (velocity magnitude) predicted by Fluent

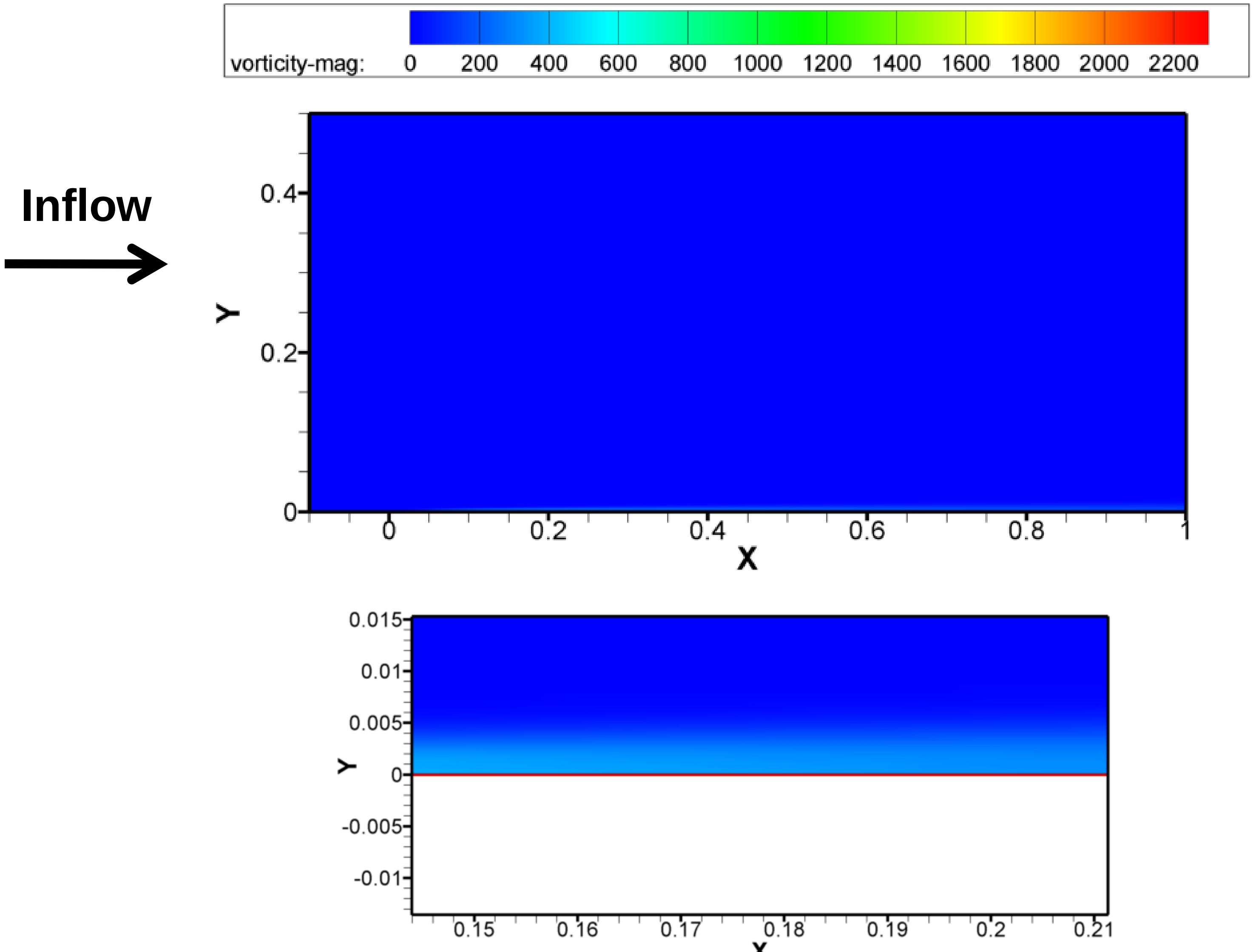
Inflow=1.35 m/s

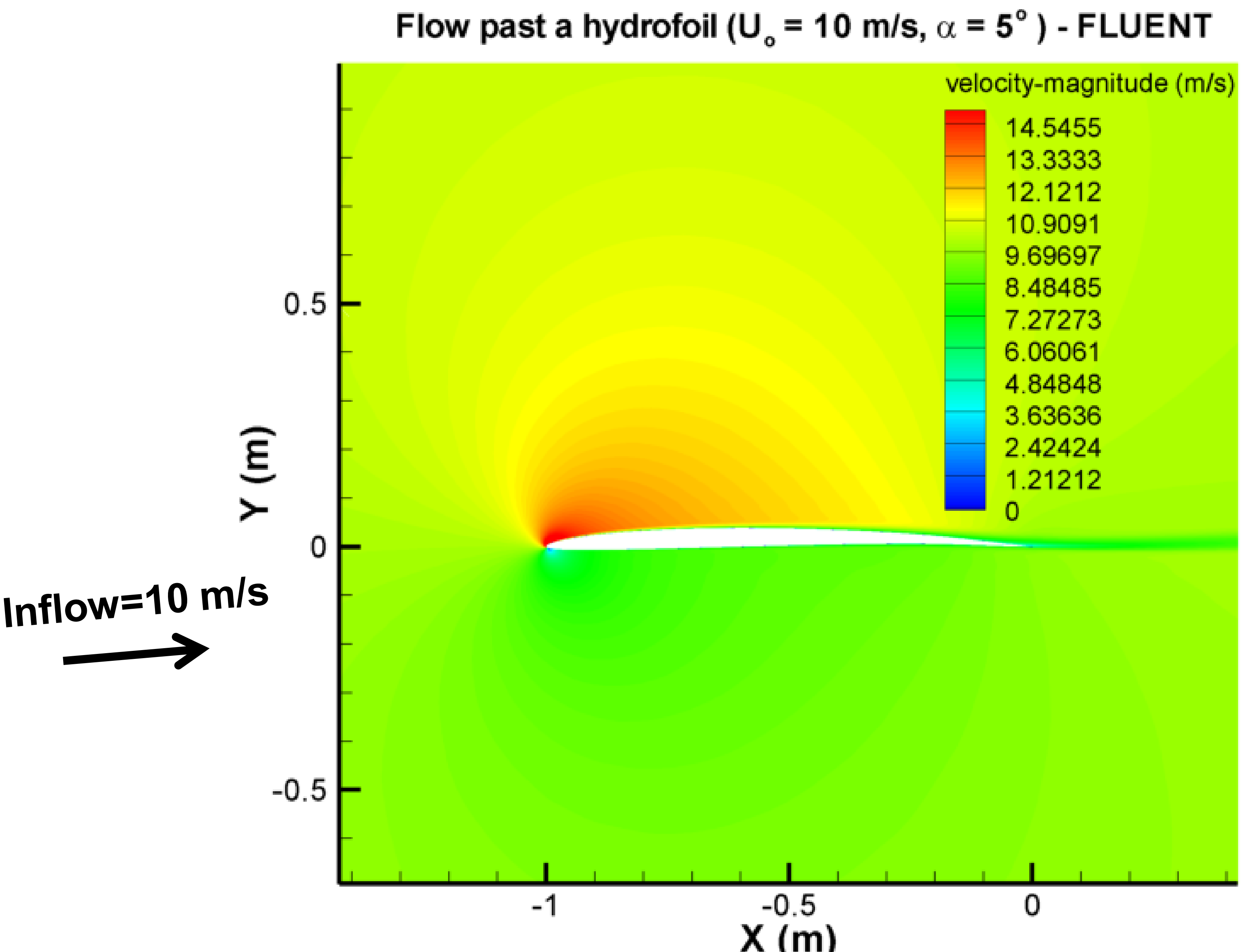


Flow over flat plate (velocity profile in boundary layer) predicted by Fluent

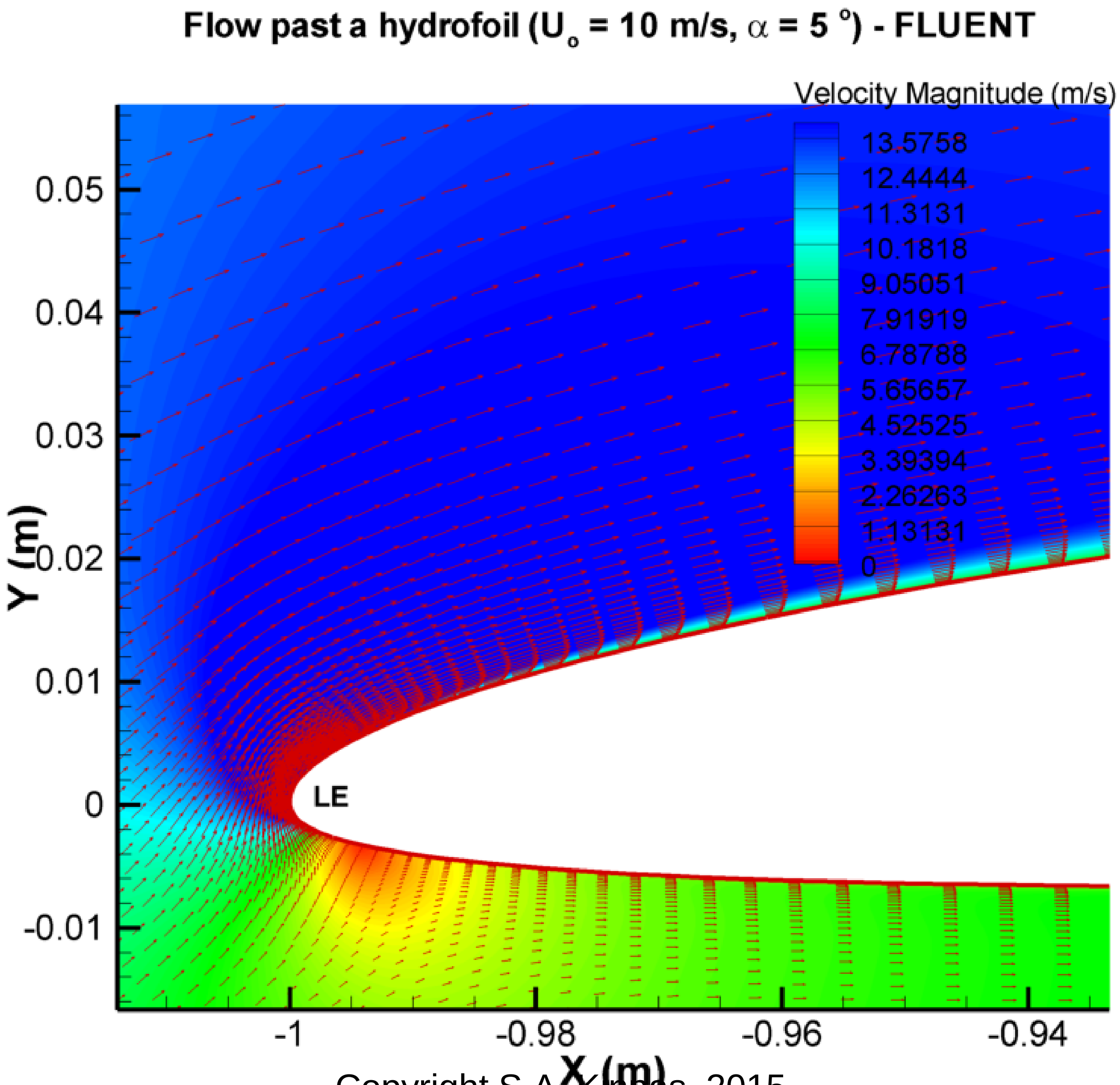


Flow over flat plate (vorticity magnitude) predicted by Fluent

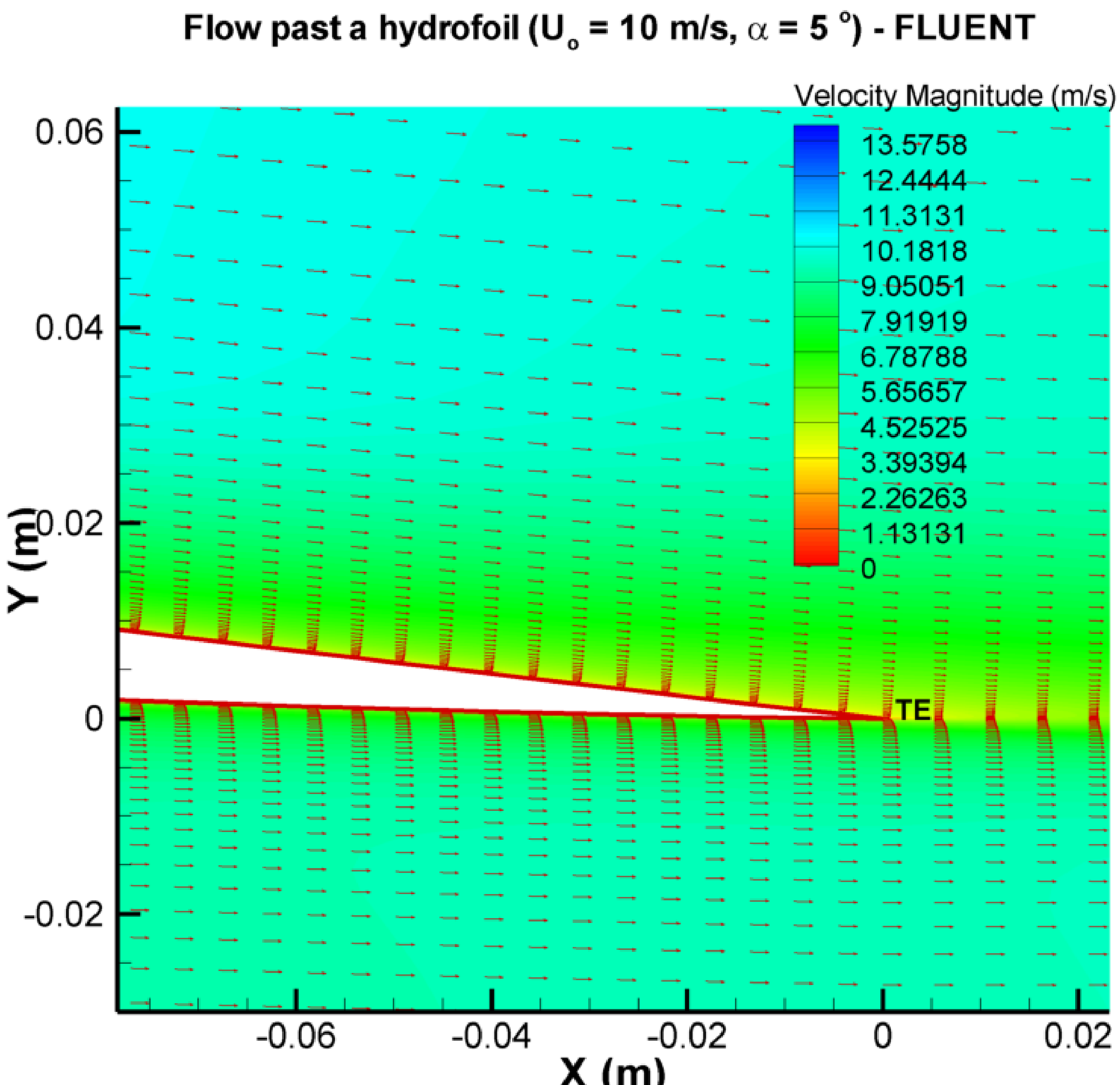


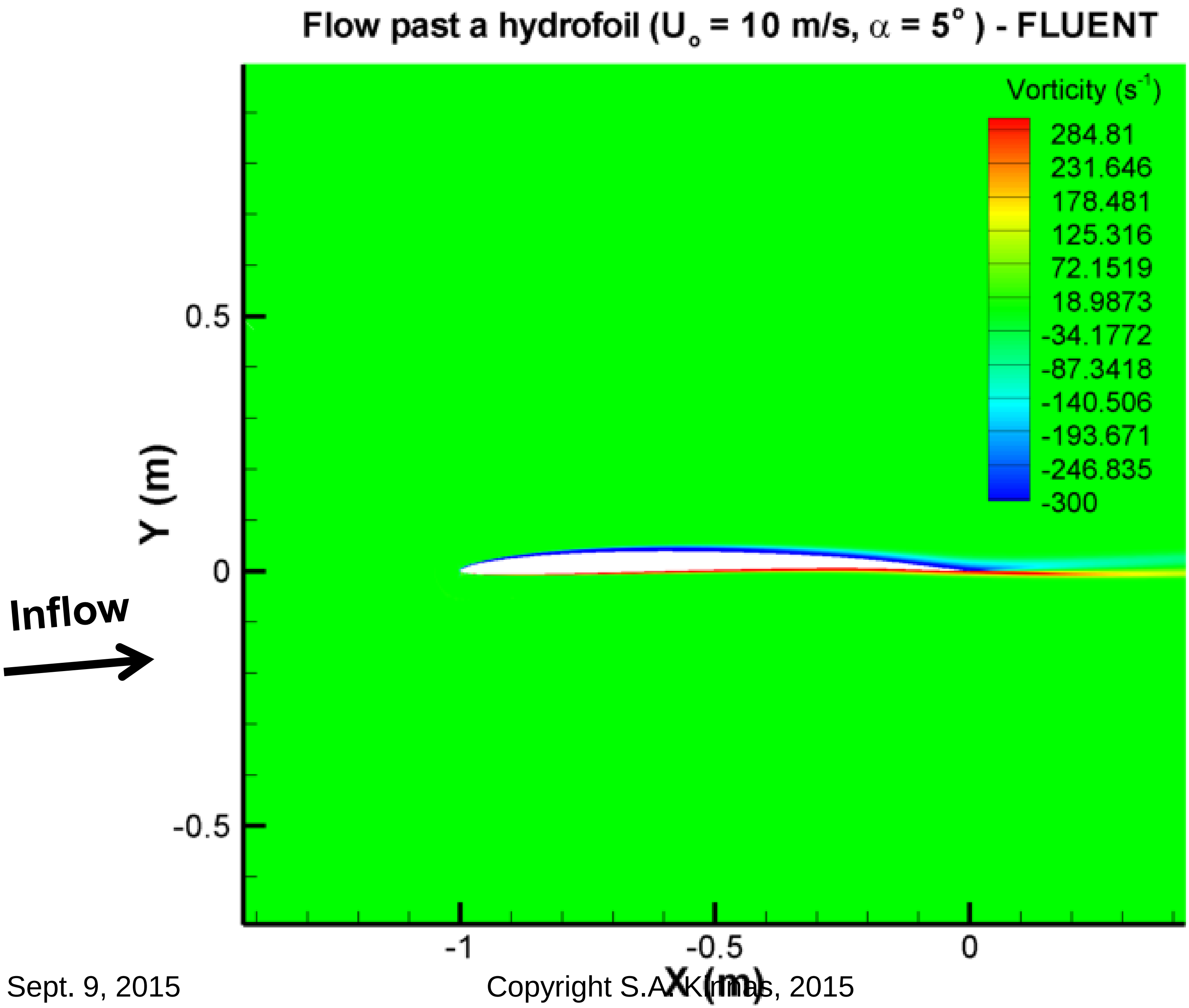

Flow past a hydrofoil (U_o = 10 m/s, α = 5°) - FLUENT
velocity-magnitude (m/s)
14.5455
13.3333
12.1212
10.9091
9.69697
8.48485
7.27273
6.06061
4.84848
3.63636
2.42424
1.21212
0
Y (m)
0.5
0
-0.5
X (m)
-1
-0.5
0
Inflow=10 m/s

Flow detail at the Leading Edge (LE) of Hydrofoil

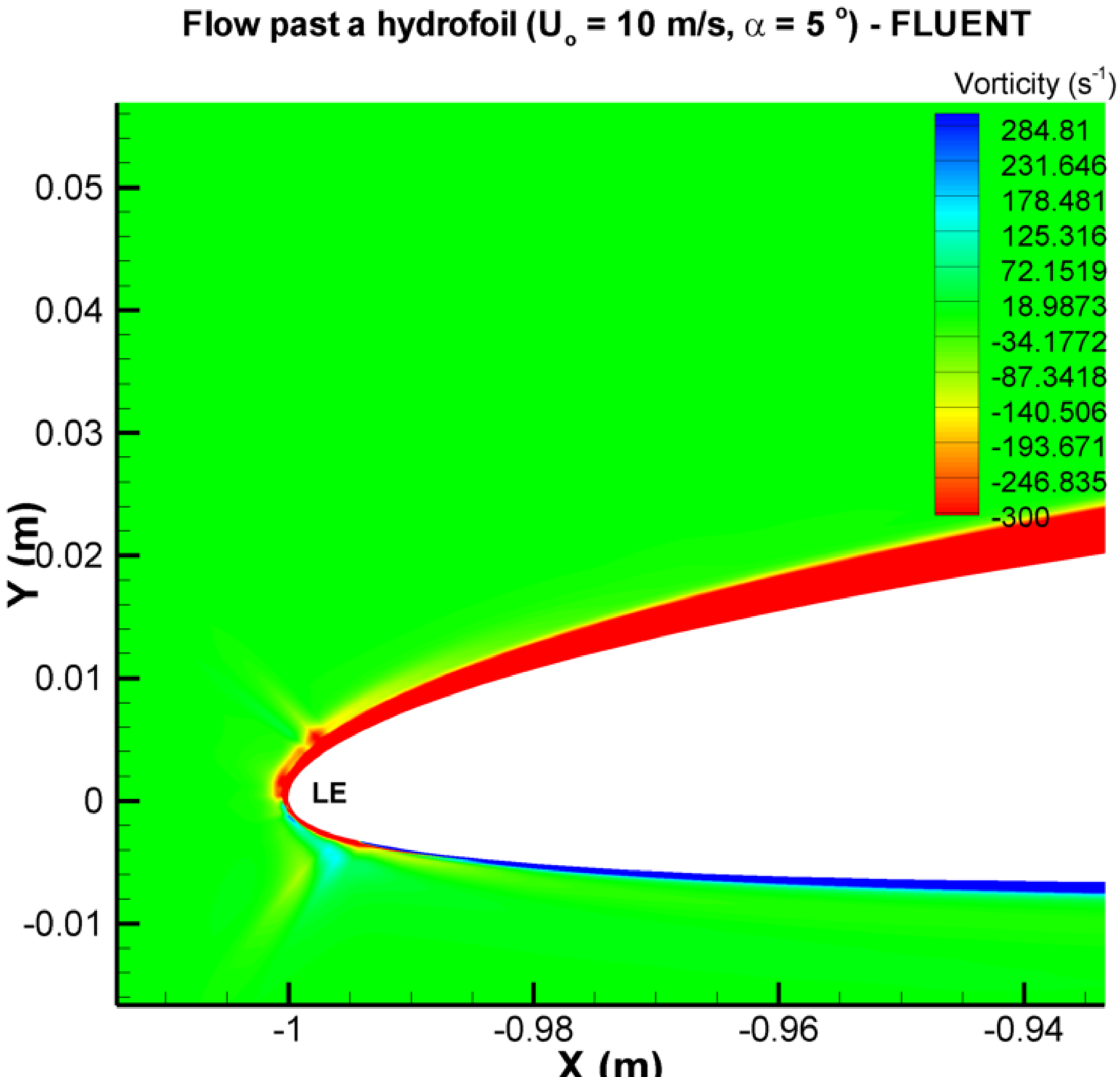


Flow detail at the Trailing Edge (TE) of the Hydrofoil

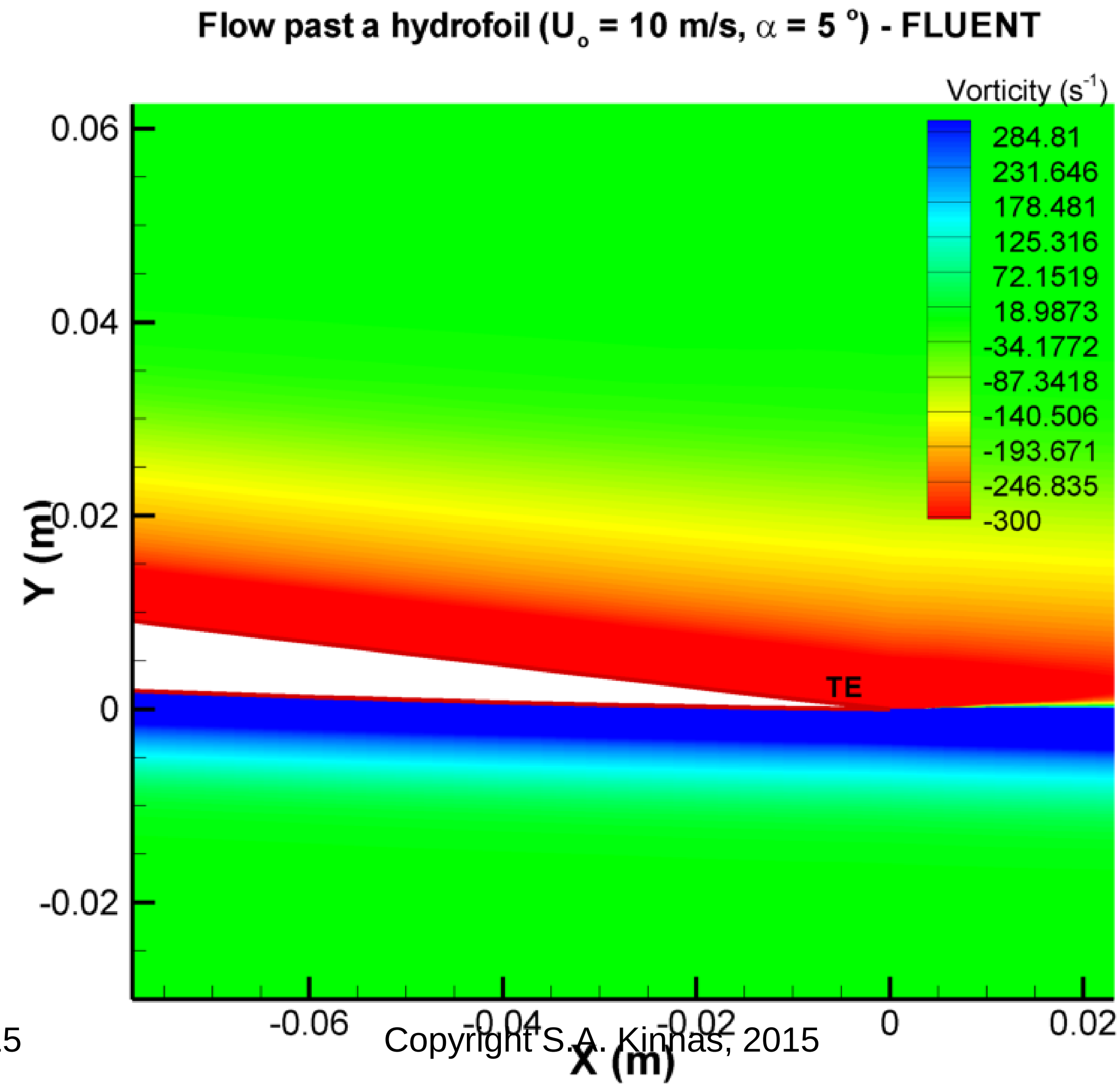



Flow past a hydrofoil (U_o = 10 m/s, α = 5°) - FLUENT
Vorticity (s^{-1})
284.81
231.646
178.481
125.316
72.1519
18.9873
-34.1772
-87.3418
-140.506
-193.671
-246.835
-300
0.5
0
-0.5
Y (m)
-1
-0.5
0
X (m)
Inflow

Vorticity detail at the Leading Edge (LE) of Hydrofoil

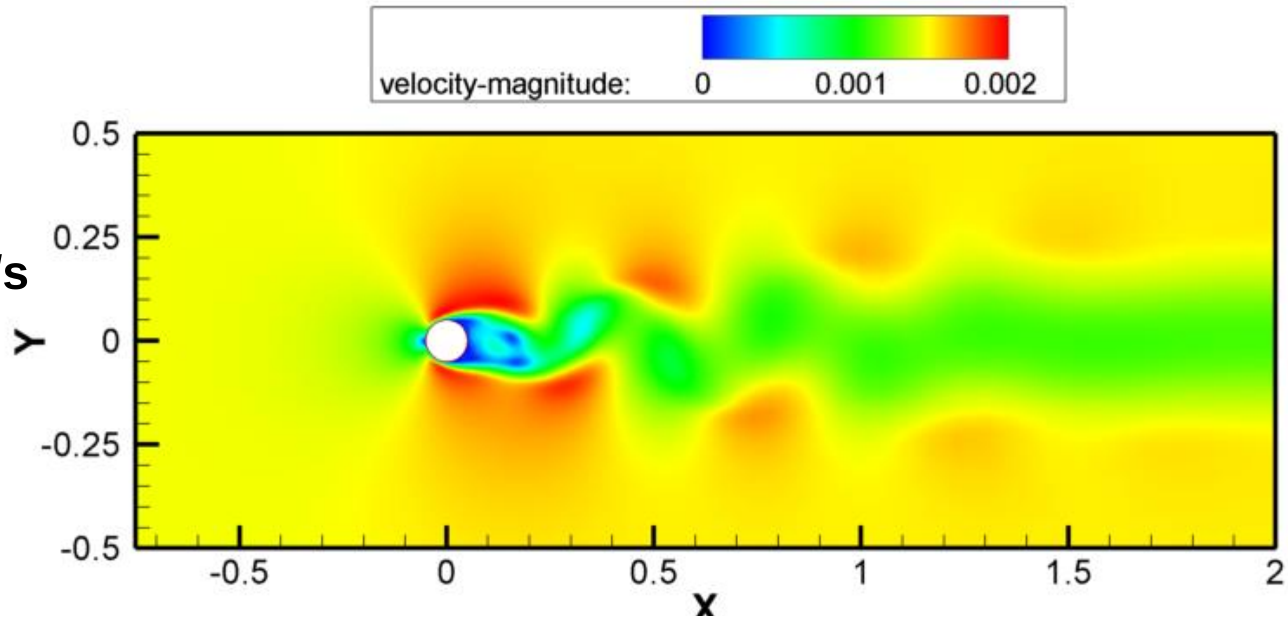


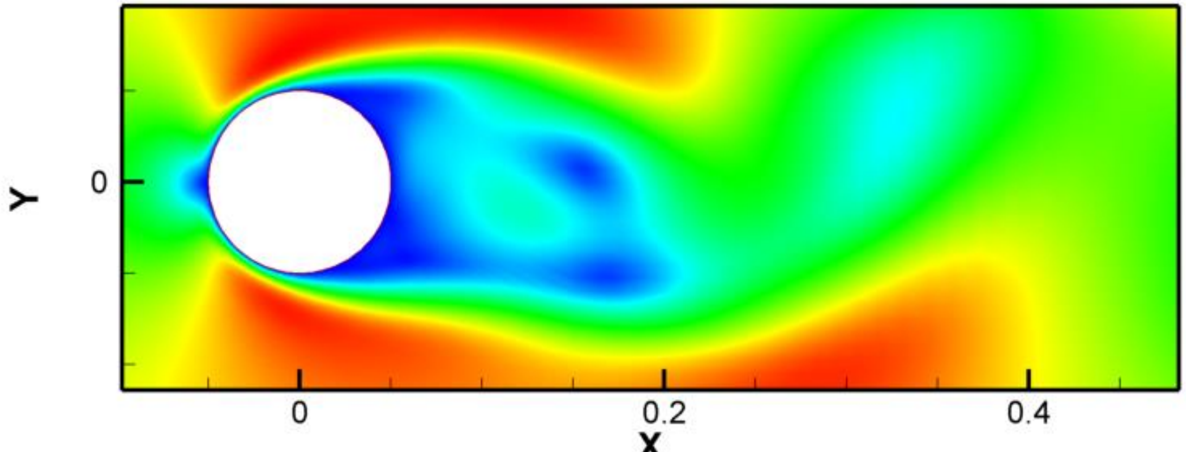
Vorticity detail at the Trailing Edge (TE) of the Hydrofoil



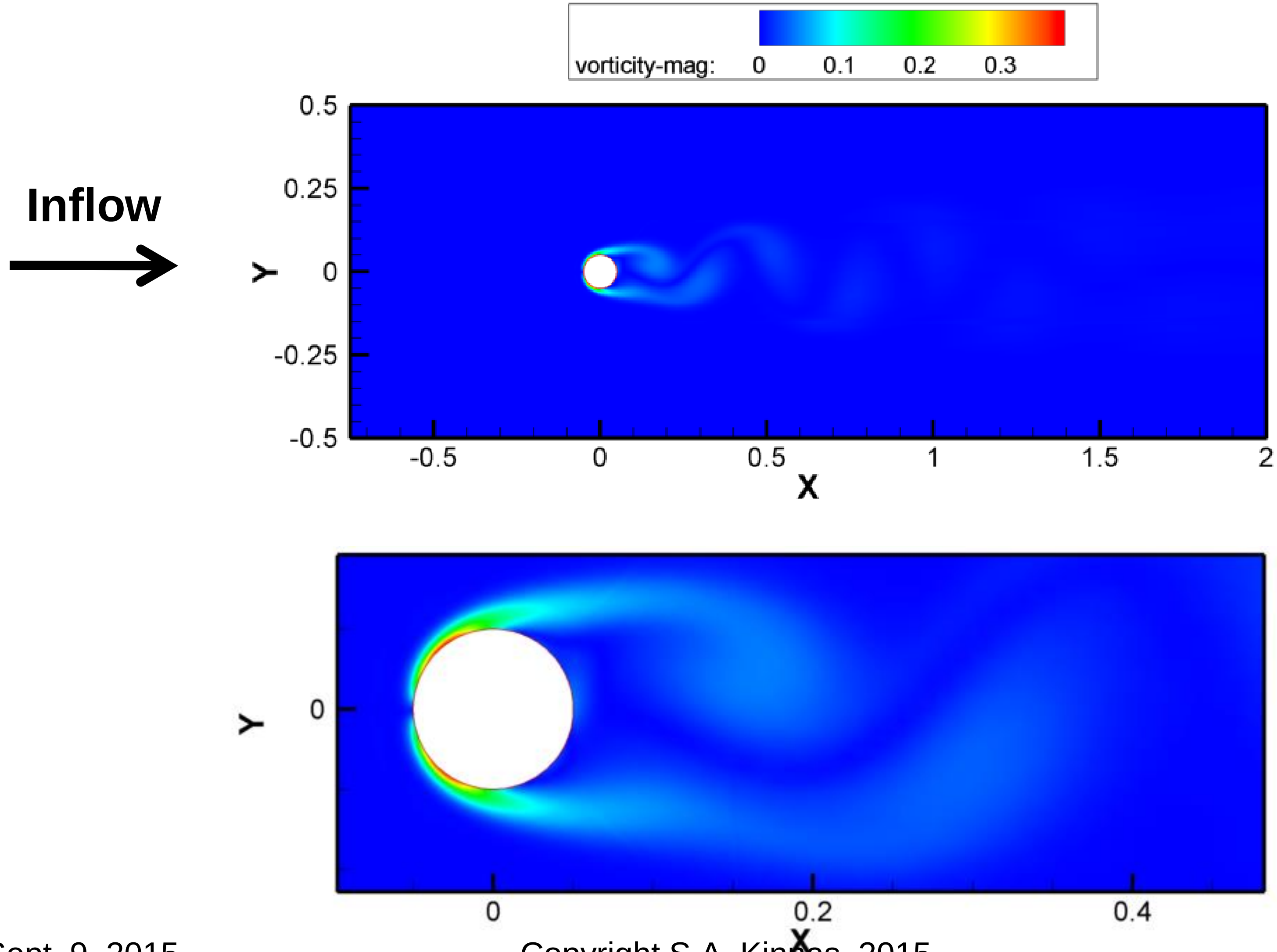
Flow around cylinder (velocity magnitude) predicted by Fluent

Inflow=0.0015 m/s

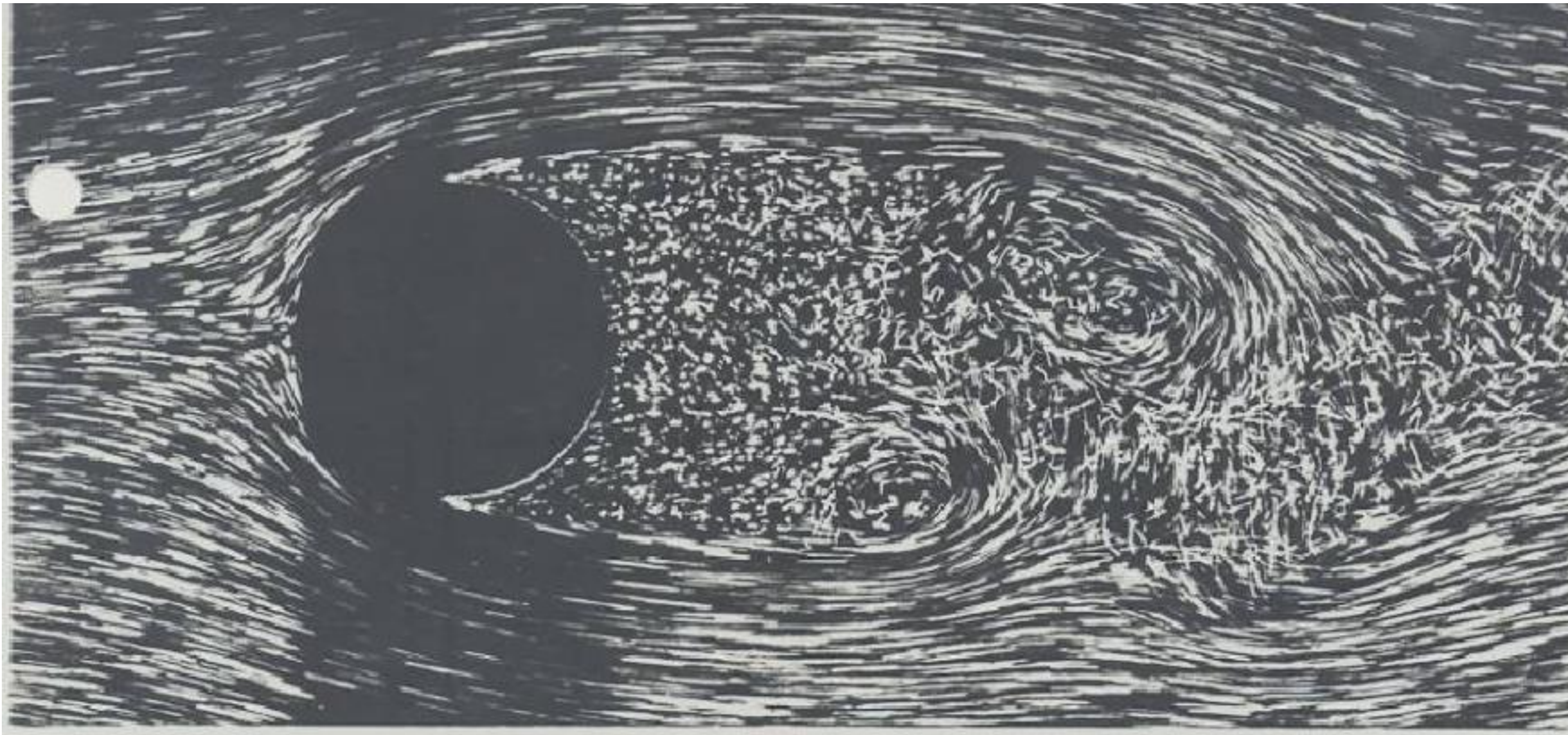




Flow around cylinder (vorticity magnitude) predicted by Fluent

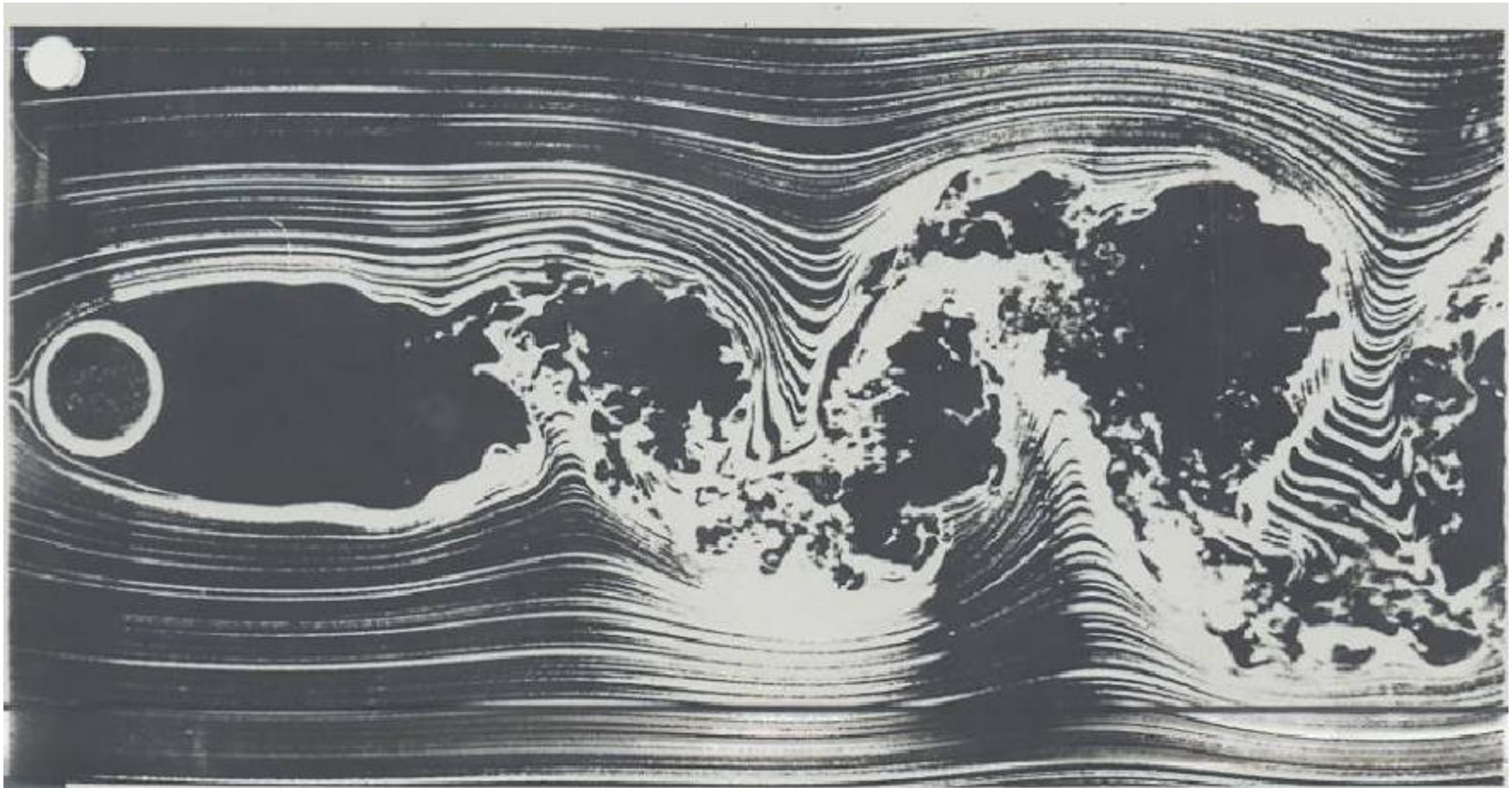


Flow around cylinder (from "An Album of Fluid Motion", by M. Van Dyke)



47. Circular cylinder at $R=2000$. At this Reynolds number one may properly speak of a boundary layer. It is laminar over the front, separates, and breaks up into a turbulent wake. The separation points, moving forward as the Reynolds number is increased, have now attained their upstream limit, ahead of maximum thickness. Visualization is by air bubbles in water. *ONERA photograph, Werlé & Gallon 1972*

Flow around cylinder (from "An Album of Fluid Motion", by M. Van Dyke)



48. Circular cylinder at R=10,000. At five times the speed of the photograph at the top of the page, the flow pattern is scarcely changed. The drag coefficient consequently remains almost constant in the range of Reynolds number spanned by these two photographs. It drops later when, as in figure 57, the boundary layer becomes turbulent at separation. *Photograph by Thomas Corke and Hassan Nagib*