# REPORT

학과: 항공기계공학과

과목: 전산유체해석실습

학번: 2023010586

이름: 이유림

교수: 임동균 교수님

제출날짜: 12/04 (목)

CHEONGJU UNIVERSITY
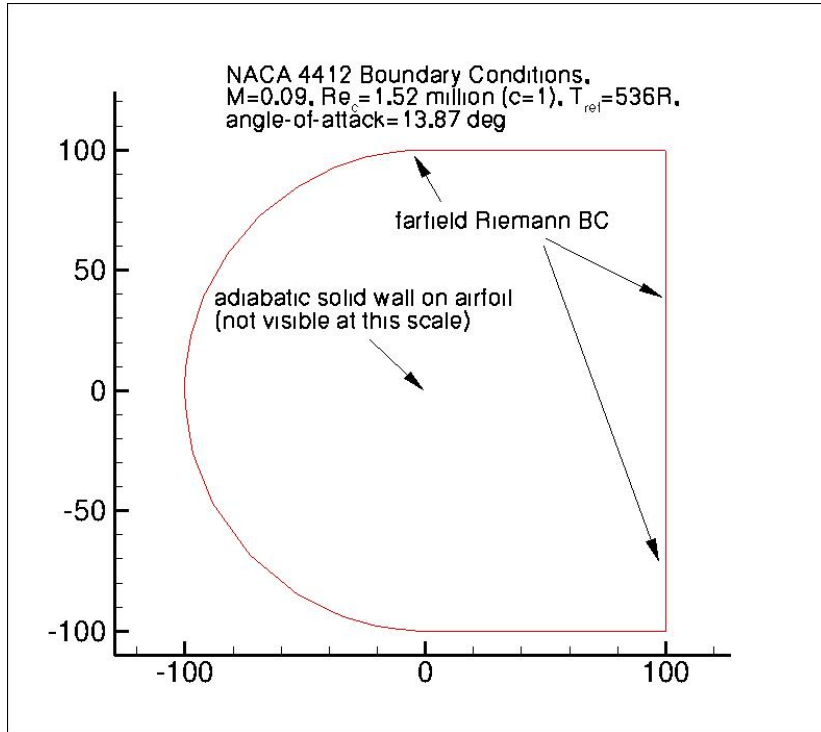
# Grids - NACA 4412
# Airfoil Trailing Edge Separation Case

# Grids - NACA 4412



NACA 4412 Boundary Conditions.
M=0.09, $Re_c$=1.52 million (c=1), $T_{ref}$=536R,
angle-of-attack=13.87 deg

farfield Riemann BC

adiabatic solid wall on airfoil
(not visible at this scale)

📄 NACA4412.su2

📰 SU2_CFD.exe

📄 unsteady_naca0012.cfg

```
% FREE-STREAM
MACH_NUMBER= 0.09
AOA= 13.87
FREESTREAM_TEMPERATURE= 293.0
FREESTREAM_PRESSURE= 101325.0
REYNOLDS_NUMBER= 1.52e6
REYNOLDS_LENGTH= 1.0


% Mesh markers: Inlet / Outlet / Symmetry / Wall
% =====================================
MARKER_FAR = ( Inlet, Outlet )
MARKER_SYM = ( Symmetry )
MARKER_HEATFLUX = ( Wall, 0.0 )
MARKER_PLOTTING = ( Wall )
MARKER_MONITORING = ( Wall )


% MESH FILE
MESH_FILENAME= NACA4412.su2
MESH_FORMAT= SU2
```

```
         File Writing Summary        |        Filename
SU2 binary restart          |restart.dat
Paraview                    |flow.vtu
Paraview surface            |surface_flow.vtu

Inner_Iter|    rms[Rho]|  rms[RhoU]|  rms[RhoV]|   rms[RhoE]|
    2001|   -7.760339|  -3.935950| -32.000000|   -2.325797|
    2002|   -7.761545|  -3.936920| -32.000000|   -2.326511|
    2003|   -7.762663|  -3.937897| -32.000000|   -2.327137|
    2004|   -7.763693|  -3.938882| -32.000000|   -2.327675|
    2005|   -7.764635|  -3.939874| -32.000000|   -2.328125|
    2006|   -7.765488|  -3.940872| -32.000000|   -2.328487|
    2007|   -7.766253|  -3.941877| -32.000000|   -2.328761|
    2008|   -7.766931|  -3.942888| -32.000000|   -2.328949|
    2009|   -7.767523|  -3.943905| -32.000000|   -2.329052|
    2010|   -7.768029|  -3.944927| -32.000000|   -2.329071|
    2011|   -7.768451|  -3.945955| -32.000000|   -2.329010|
    2012|   -7.768790|  -3.946987| -32.000000|   -2.328870|
    2013|   -7.769050|  -3.948024| -32.000000|   -2.328654|
    2014|   -7.769230|  -3.949064| -32.000000|   -2.328366|
    2015|   -7.769335|  -3.950108| -32.000000|   -2.328008|
    2016|   -7.769367|  -3.951156| -32.000000|   -2.327583|
    2017|   -7.769328|  -3.952205| -32.000000|   -2.327097|
    2018|   -7.769222|  -3.953258| -32.000000|   -2.326552|
    2019|   -7.769051|  -3.954312| -32.000000|   -2.325954|
    2020|   -7.768819|  -3.955367| -32.000000|   -2.325305|
    2021|   -7.768529|  -3.956423| -32.000000|   -2.324612|
    2022|   -7.768186|  -3.957480| -32.000000|   -2.323877|
    2023|   -7.767791|  -3.958537| -32.000000|   -2.323107|
    2024|   -7.767351|  -3.959594| -32.000000|   -2.322305|
    2025|   -7.766867|  -3.960649| -32.000000|   -2.321476|
    2026|   -7.766345|  -3.961704| -32.000000|   -2.320625|
    2027|   -7.765788|  -3.962756| -32.000000|   -2.319756|
    2028|   -7.765200|  -3.963807| -32.000000|   -2.318874|
    2029|   -7.764586|  -3.964856| -32.000000|   -2.317984|
    2030|   -7.763948|  -3.965902| -32.000000|   -2.317090|
    2031|   -7.763291|  -3.966944| -32.000000|   -2.316196|
    2032|   -7.762619|  -3.967984| -32.000000|   -2.315306|
    2033|   -7.761936|  -3.969019| -32.000000|   -2.314425|
    2034|   -7.761245|  -3.970051| -32.000000|   -2.313557|
    2035|   -7.760551|  -3.971079| -32.000000|   -2.312705|
    2036|   -7.759856|  -3.972103| -32.000000|   -2.311873|
    2037|   -7.759165|  -3.973122| -32.000000|   -2.311066|
    2038|   -7.758480|  -3.974136| -32.000000|   -2.310285|
    2039|   -7.757805|  -3.975146| -32.000000|   -2.309535|
    2040|   -7.757144|  -3.976152| -32.000000|   -2.308818|
    2041|   -7.756500|  -3.977153| -32.000000|   -2.308139|
    2042|   -7.755875|  -3.978149| -32.000000|   -2.307498|
    2043|   -7.755273|  -3.979141| -32.000000|   -2.306901|
    2044|   -7.754696|  -3.980128| -32.000000|   -2.306347|
    2045|   -7.754146|  -3.981111| -32.000000|   -2.305841|
    2046|   -7.753627|  -3.982089| -32.000000|   -2.305385|
    2047|   -7.753141|  -3.983064| -32.000000|   -2.304979|
    2048|   -7.752689|  -3.984035| -32.000000|   -2.304626|
    2049|   -7.752274|  -3.985002| -32.000000|   -2.304328|
    2050|   -7.751897|  -3.985966| -32.000000|          -|
-3.934988|  -32.000000|   -2.324996|
```
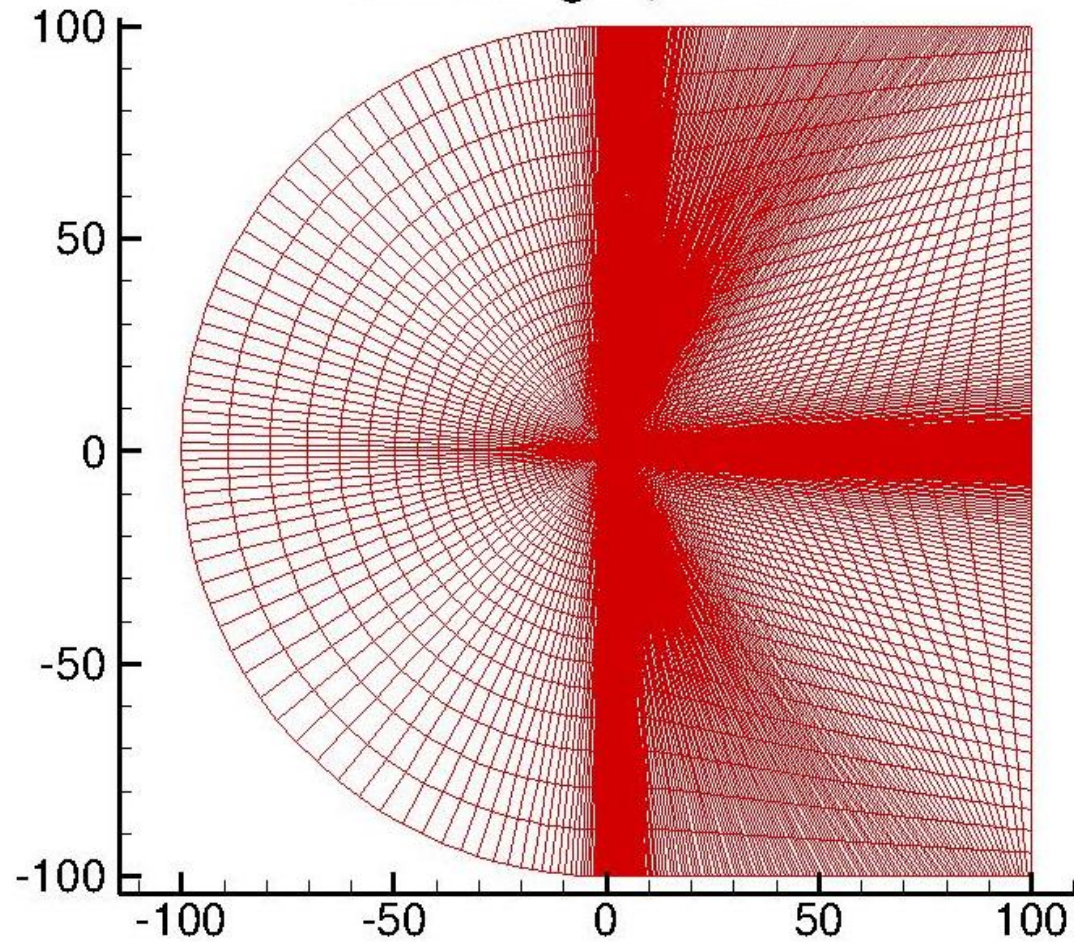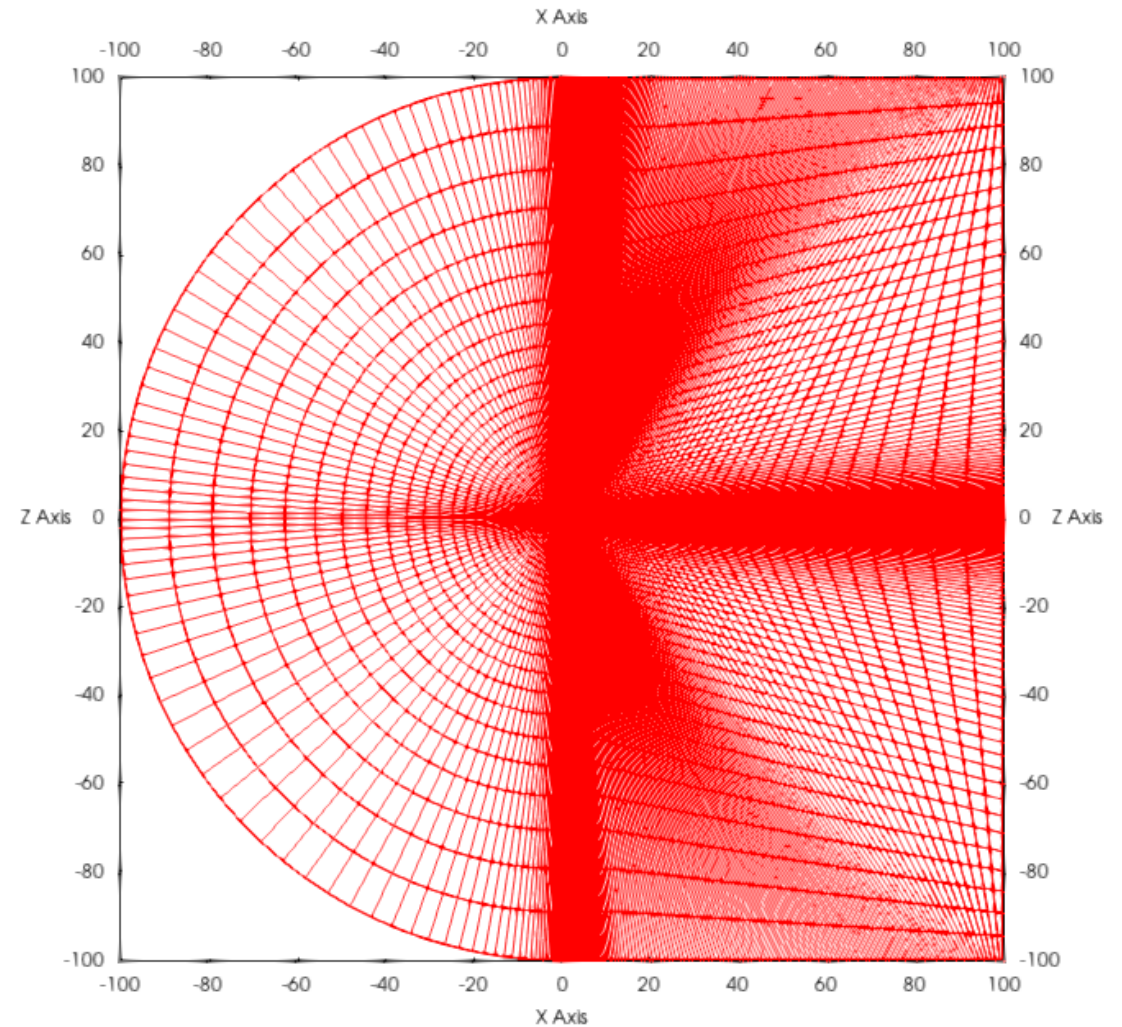
# Grids - NACA 4412

### 449 x 129 grid, far view



[ NACA4412_mesh ]
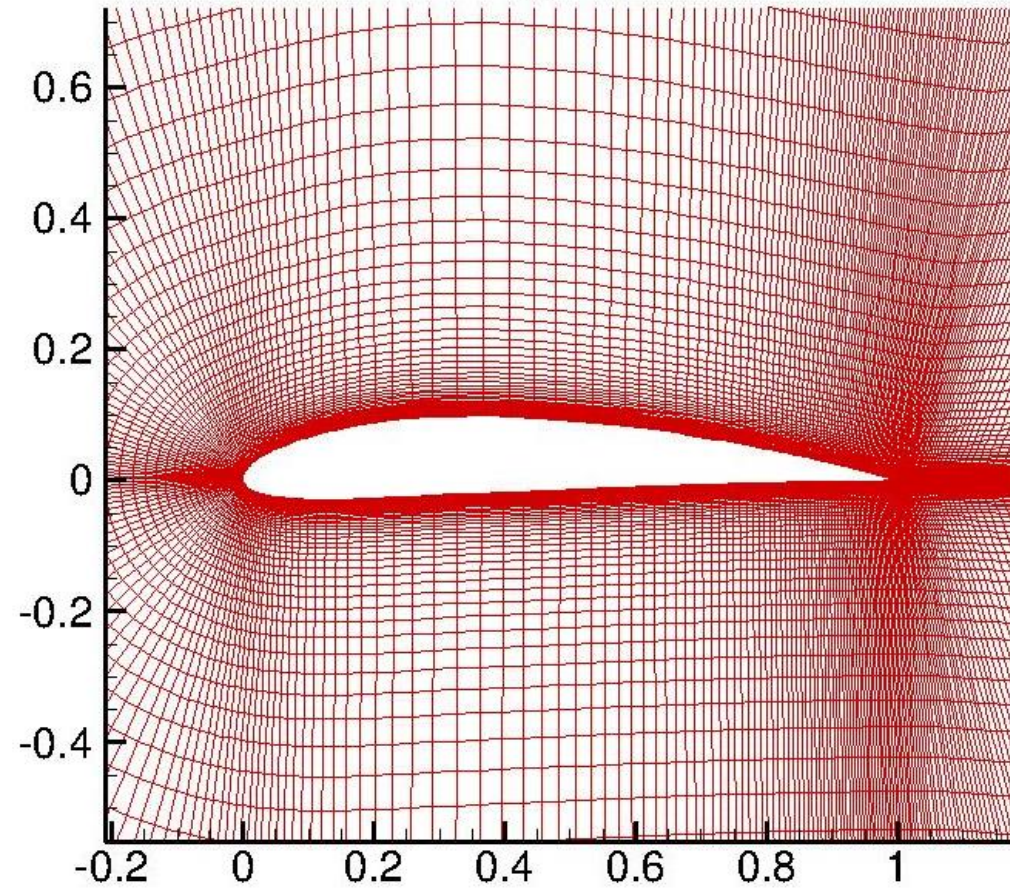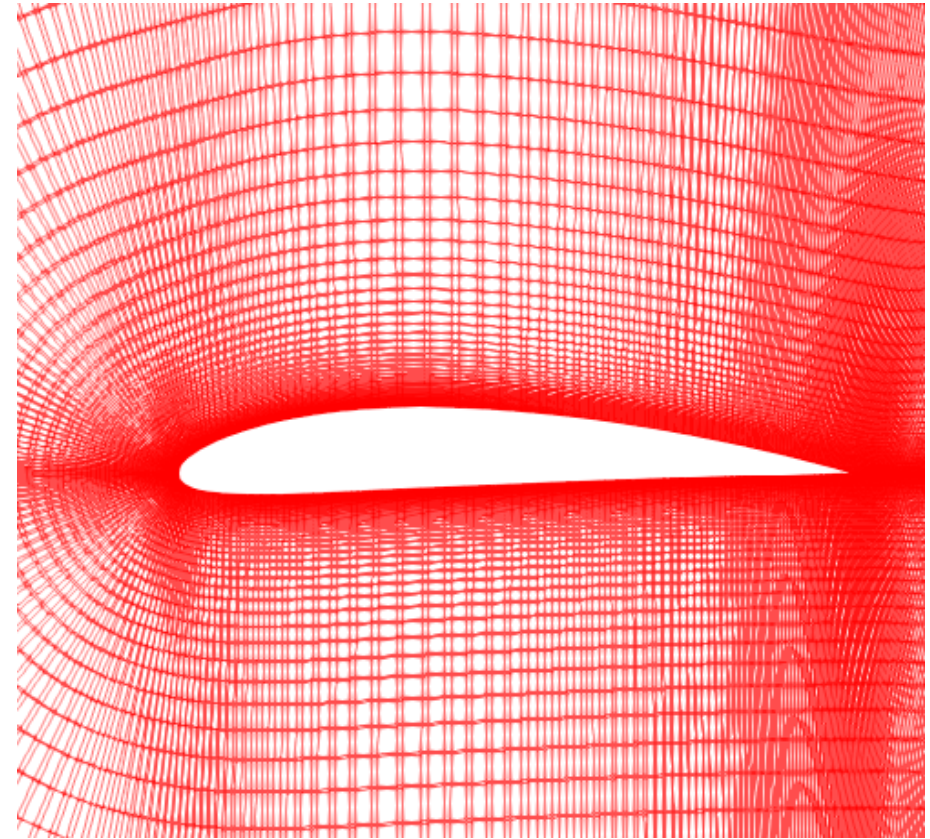
[ NACA4412_mesh_SU2 ]

# Grids - NACA 4412



449 x 129 grid, near view
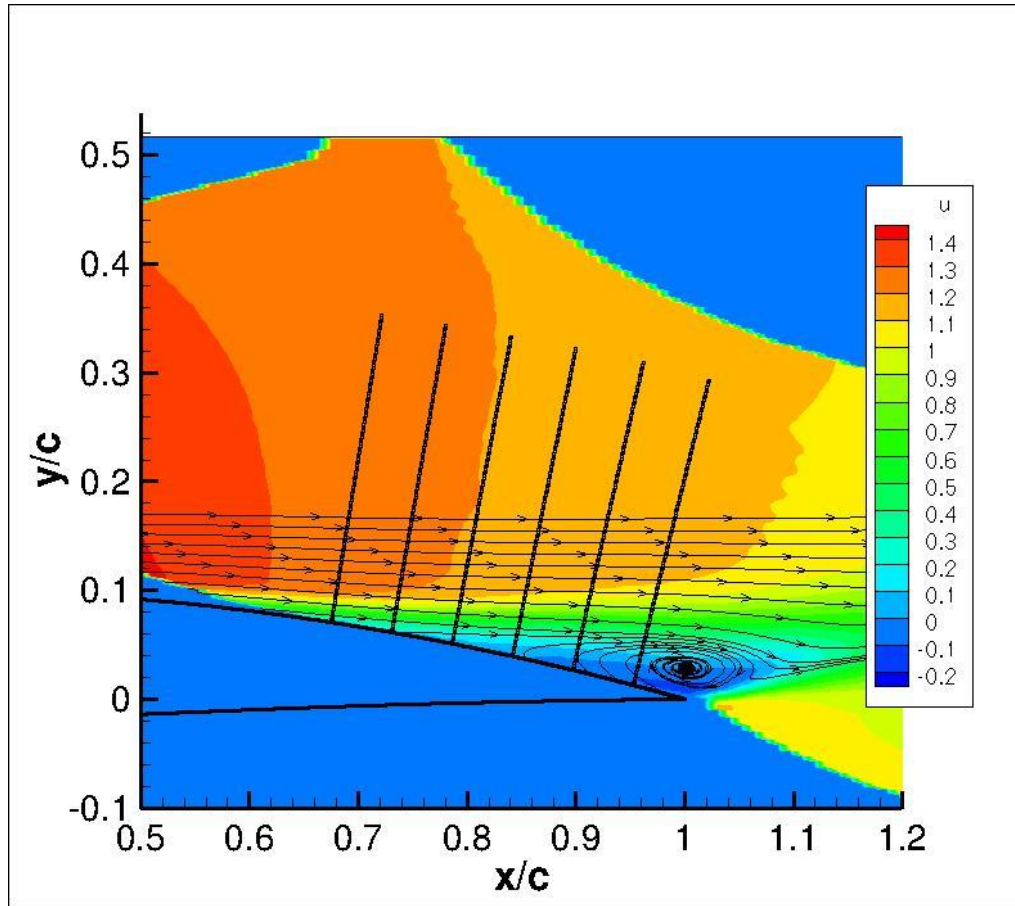
[ NACA4412_airfoil ]



[ NACA4412_airfoil_SU2 ]

# 2DN44: 2D NACA 4412

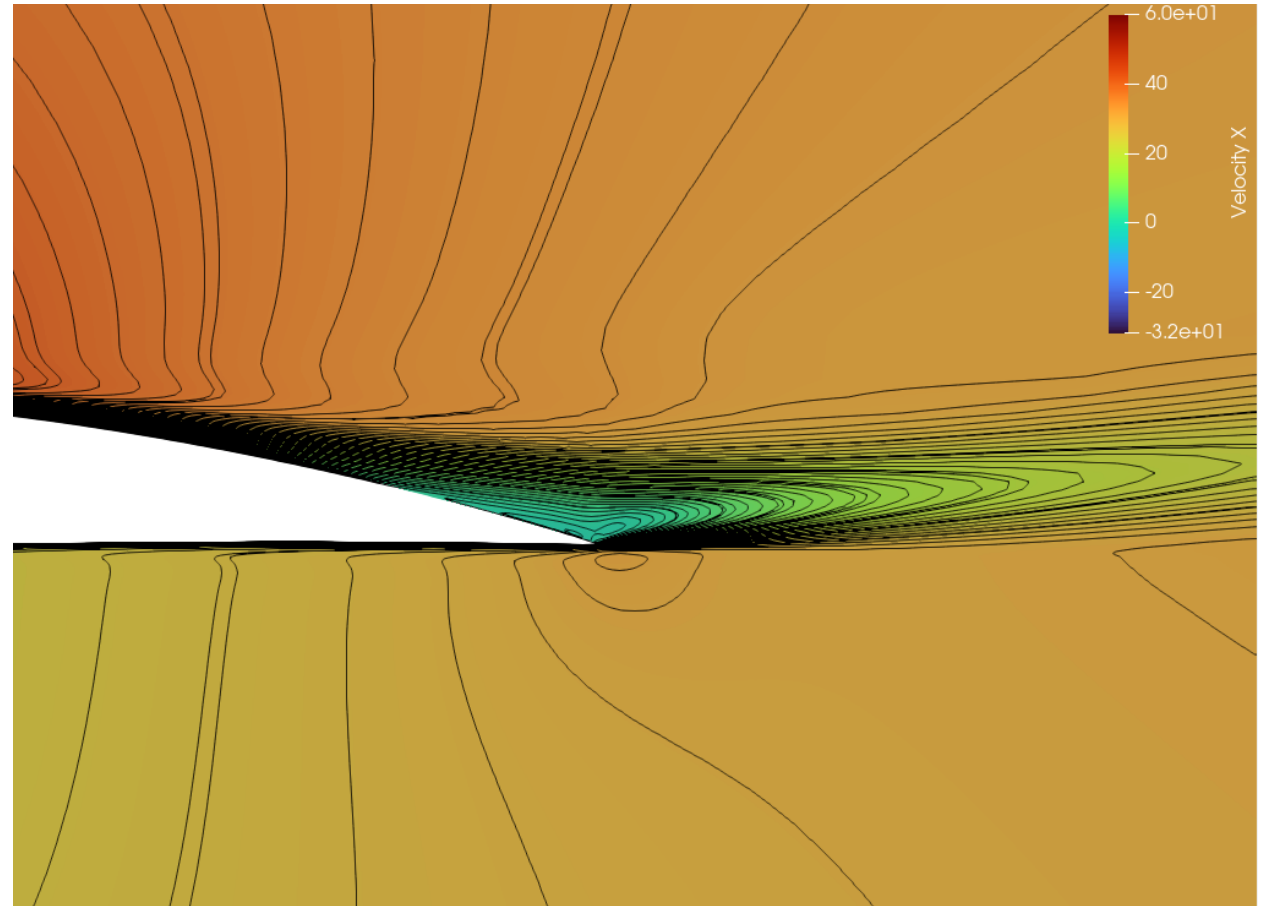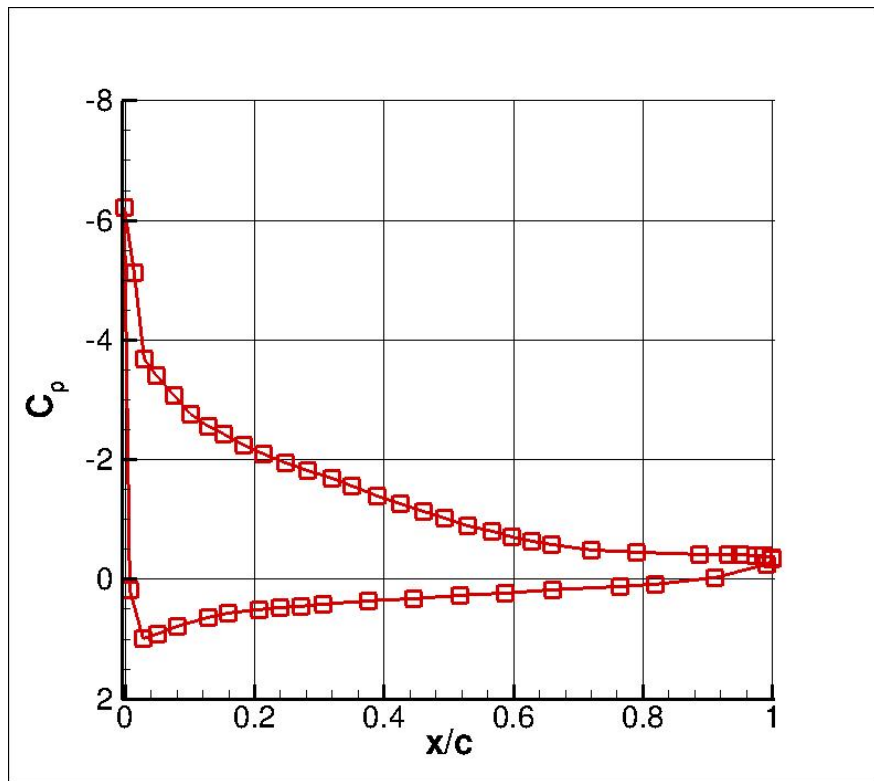# 2DN44: 2D NACA 4412

[ 유동 박리 발생하는 것 관찰 ]



[ NACA4412 ]



[ NACA4412_SU2 ]

# 2DN44: 2D NACA 4412

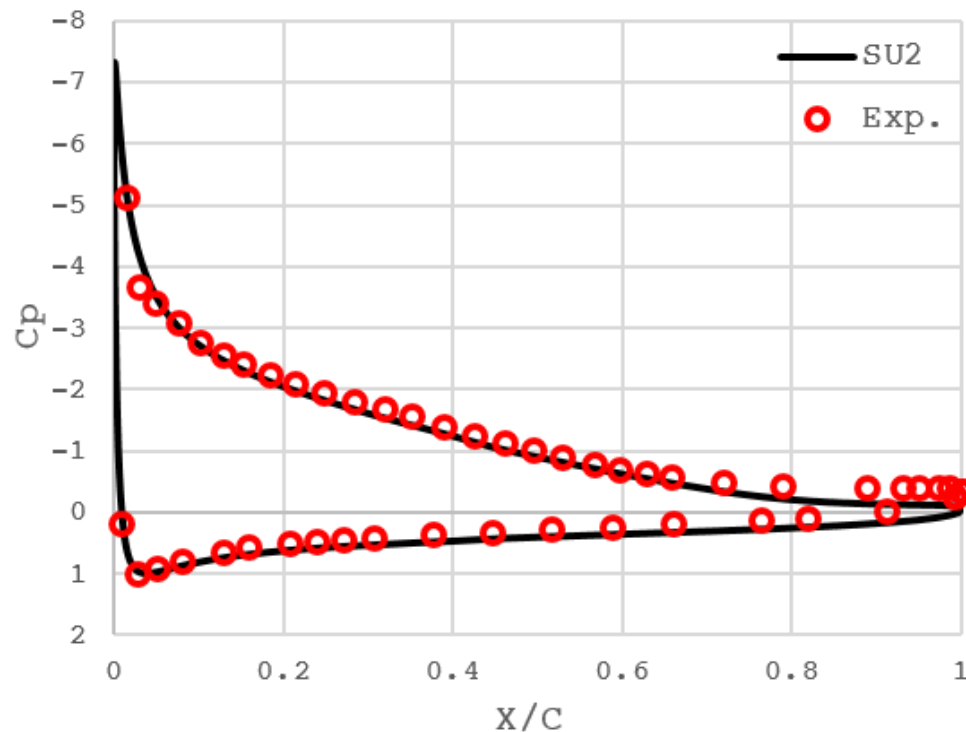[ 유동 박리 발생하는 것 관찰 ]



[ NACA4412 ]



[ NACA4412_SU2 ]

**익형 하부** (Lower Surface) :
날개 하부는 상대적으로 높은 압력 영역
SU2 해석 결과는 하부 전체 구간에서 NASA의 기준 데이터와 거의 차이가
없을 만큼 정확하게 일치
이는 양력 발생에 기여하는 하부 유동장 해석의 신뢰도를 높여줍니다.

**익형 상부** (Upper Surface) :
압력이 감소하다가 후방으로 가면서 증가하여 원래 압력으로
회복되는 구간(Pressure Recovery)이 발생합니다.