

ESERCITAZIONE n. 2 al Corso di Aerodinamica degli Aeromobili
Prof. Carlo de Nicola

AERODINAMICA DEL PROFILO ALARE ALLE BASSE VELOCITÀ DI VOLO CON
SISTEMI DI IPERSOSTENTAZIONE - ESECUZIONE IN BATCH

Lo strumento di lavoro di riferimento è il codice **XFOIL**
(Esistono altro software che hanno scopi simili , citiamo XFLR 5 e JavaFoil)

Il software è scaricabile da

- <http://wpage.unina.it/denicola/AdA/DOWNLOAD/> - Materiale Lezioni Xfoil.zip che contiene il SW Xfoil 6.96 per Windows insieme a due profili, non generabili automaticamente con Xfoil, per mostrare il format dell'I/O.
- <https://web.mit.edu/drela/Public/web/xfoil/>

In queste esercitazioni utilizzeremo XFOIL

Università degli Studi Federico II – Napoli - Ingegneria Aerospaziale - Laurea Magistrale
Corso di Aerodinamica degli Aeromobili

XFOIL
Profilo in esame :
NASA SC(2)-0610 AIRFOIL

Airfoil Tools You have 0 airfoils loaded. Your Reynold number range is 50,000 to 1,000,000. (...)

Search 1638 airfoils Google Custom Search

Applications
[Airfoil database search](#)
[My airfoils](#)
[Airfoil plotter](#)
[Airfoil comparison](#)
[Reynolds number calc](#)
[NACA 4 digit generator](#)
[NACA 5 digit generator](#)

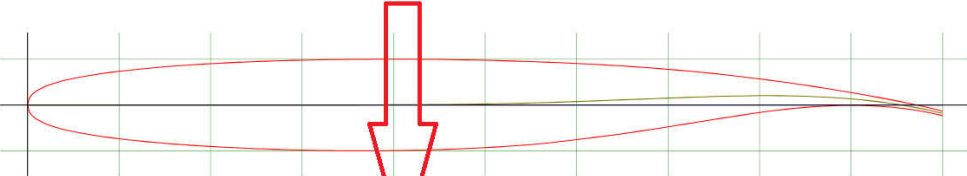
Information
[Airfoil data](#)
[Lift/drag polars](#)
[Generated airfoil shapes](#)

Searches
[Symmetrical airfoils](#)
[NACA 4 digit airfoils](#)
[NACA 5 digit airfoils](#)
[NACA 6 series airfoils](#)

Airfoils A to Z
[A a18 to avistar \(88\)](#)
[B b29root to bw3 \(22\)](#)
[C c141a to curtisc72 \(40\)](#)
[D dae11 to du861372 \(28\)](#)
[E e1098 to esa40 \(209\)](#)
[F falcon to fxs21158 \(121\)](#)
[G geminism to gu255118 \(419\)](#)
[H hh02 to ht23 \(63\)](#)
[I isa571 to isa962 \(4\)](#)

NASA SC(2)-0610 AIRFOIL (sc20610-il)
 NASA SC(2)-0610 AIRFOIL - NASA SC(2)-0610 airfoil (NASA TP-2969)

la descrizione dei punti parte dal LE



Details
 (sc20610-il) NASA SC(2)-0610 AIRFOIL
 NASA SC(2)-0610 airfoil (NASA TP-2969)
 Max thickness 10% at 38% chord.
 Max camber 1.8% at 82% chord
 Source [UIUC Airfoil Coordinates Database](#)
[Source dat file](#)
 The dat file is in Lednicer format

Dat file

NASA SC(2)-0610 AIRFOIL	
x	y
0.000000	0.000000
0.002000	0.007600
0.005000	0.011600
0.010000	0.015500

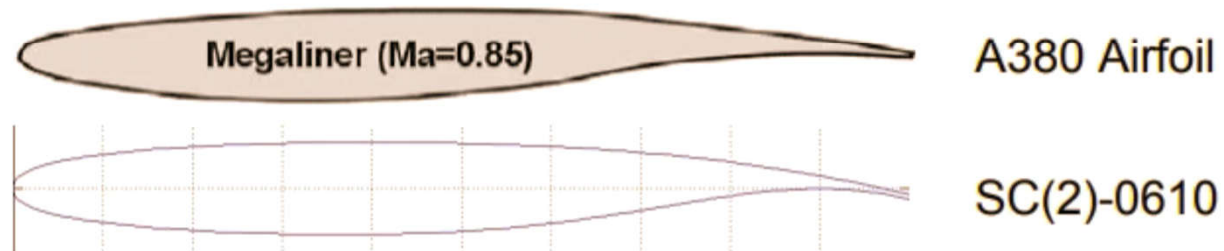
Parser
No parser warnings

[Send to airfoil plotter](#)
[Add to comparison](#)
[Lednicer format dat file](#)
[Selig format dat file](#)

Per cui è necessario riordinarli

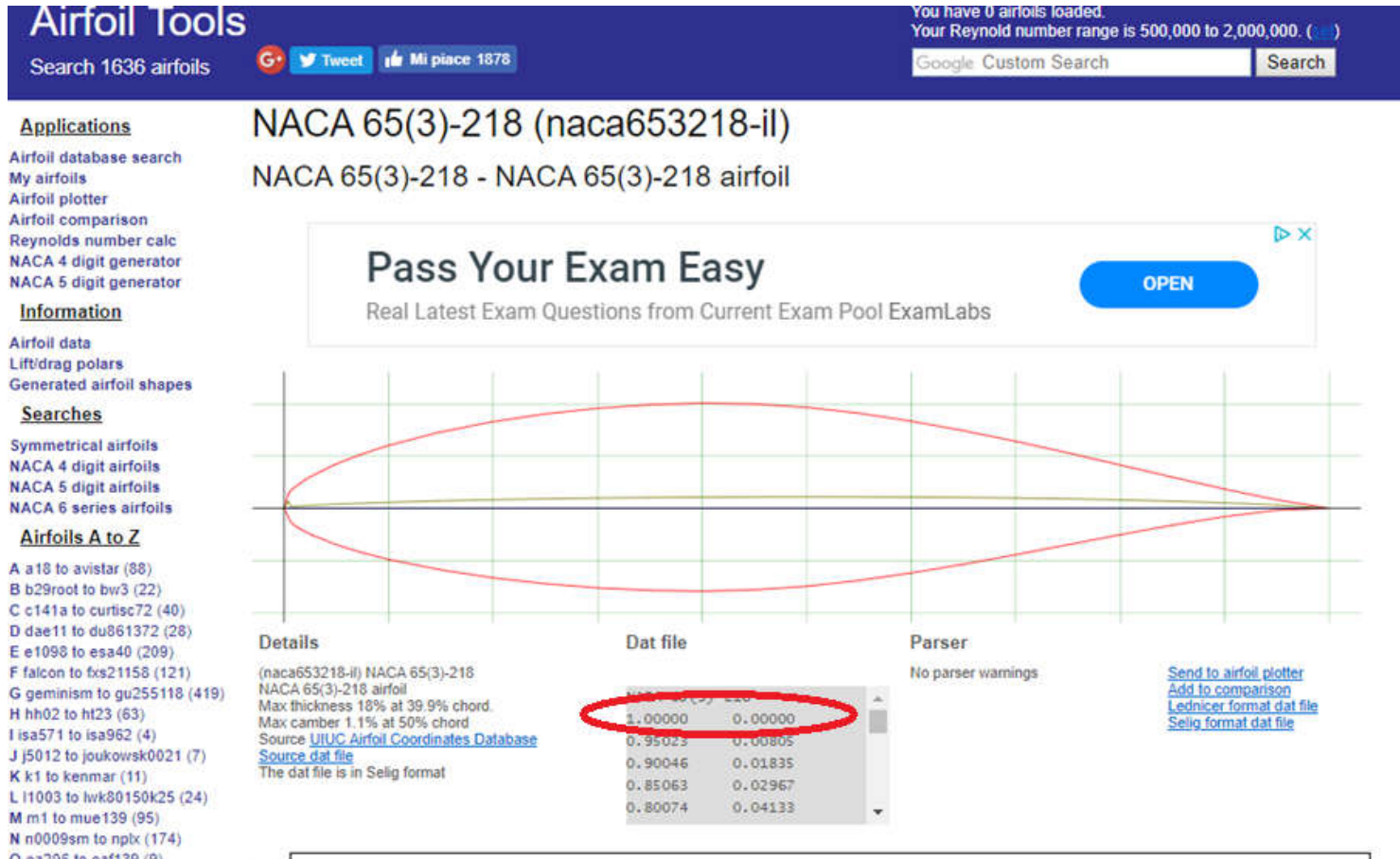
Airfoil Analysis

- Approximated the root airfoil to be a **NASA SC(2)-0610** and the tip airfoil to be a **NASA SC(2)-0606**.
 - Based on similar geometries and thicknesses.



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Profilo di lavoro NACA 65₃ 218 (Profilo laminare della Sesta Serie)



Airfoil Tools
Search 1636 airfoils

You have 0 airfoils loaded.
Your Reynold number range is 500,000 to 2,000,000. ()

Google Custom Search Search

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NACA 6 series airfoils

Airfoils A to Z
A a18 to avistar (88)
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E e1098 to esa40 (209)
F falcon to fxs21158 (121)
G geminism to gu255118 (419)
H hh02 to ht23 (63)
I isa571 to isa962 (4)
J j5012 to joukowsk0021 (7)
K k1 to kenmar (11)
L l1003 to lwk80150k25 (24)
M m1 to mue139 (95)
N n0009sm to np1x (174)
O o206 to o3f139 (9)

NACA 65(3)-218 (naca653218-il)
NACA 65(3)-218 - NACA 65(3)-218 airfoil

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OPEN

Details
(naca653218-il) NACA 65(3)-218
NACA 65(3)-218 airfoil
Max thickness 18% at 39.9% chord.
Max camber 1.1% at 50% chord
Source [UIUC Airfoil Coordinates Database](#)
[Source dat file](#)
The dat file is in Selig format

Dat file

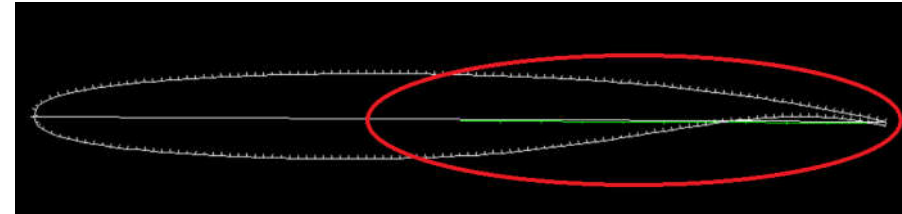
1.00000	0.00000
0.95023	0.00805
0.90046	0.01835
0.85063	0.02967
0.80074	0.04133

Parser
No parser warnings

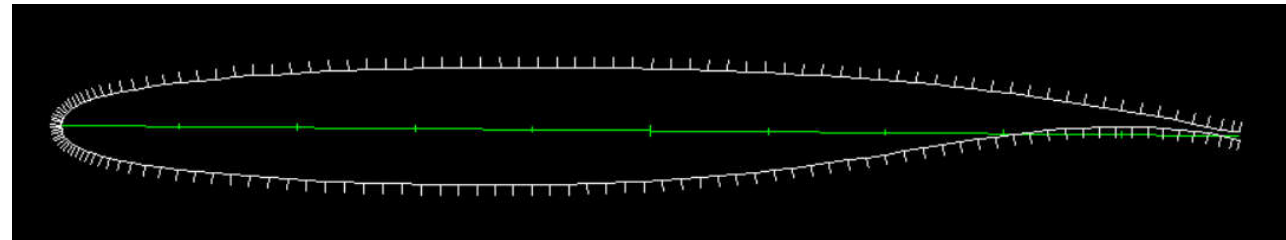
[Send to airfoil plotter](#)
[Add to comparison](#)
[Lednicer format dat file](#)
[Selig format dat file](#)

Source Data file : [già ordinato per Xfoil](#)

XFOIL c> load NASA_SC2_0610.txt



XFOIL c> load nasaa380.txt

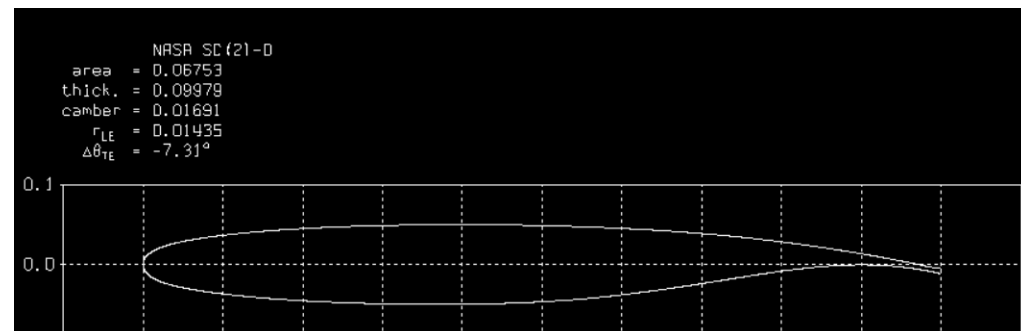


XFOIL c> pane

XFOIL c> ppar

ri-pannelliamo lasciando il parametro
Npan in xfoil.rdef a 160 e mostriamo

XFOIL c> gdes



MODIFICA DELLA GEOMETRIA (inserimento di un Flap)

**DETERMINARE LE COORDINATE DELLA CERNIERA (in mezzeria) DEL FLAP
ASSEGNARE L'ANGOLO DI DEFLESSIONE**

NASA_SC2_0610

posizione hinge ; x =

posizione hinge ; y = 0,0076

.GDES c> flap

Enter flap hinge x location r> 0.7

Top surface: y = 0.0389 y/t = 1.0

Bottom surface: y = -0.0238 y/t = 0.0

Enter flap hinge y location (or 999 to specify y/t) r> 0.0076

Flap hinge: x,y = 0.70000 0.00760

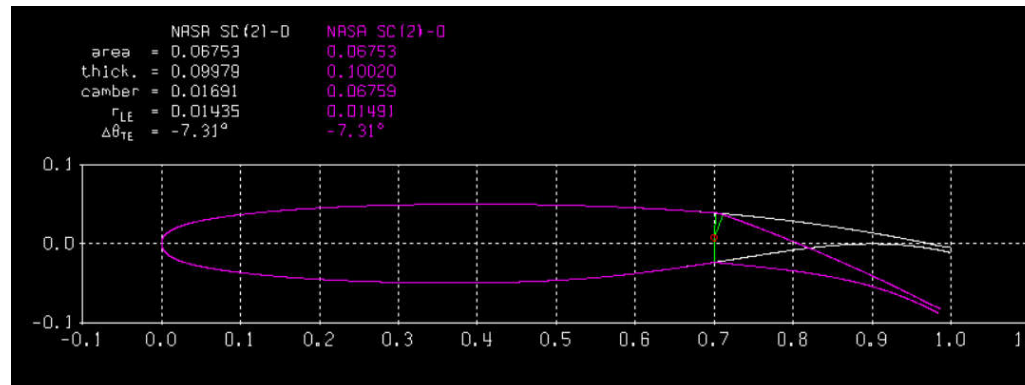
Enter flap deflection in degrees (+ down)
r> 15

Top breaks: x,y = 0.70250 0.03872
0.70250 0.03872

Bot breaks: x,y = 0.70090 -0.02366
0.70896 -0.02236

Max thickness = 0.100201 at x =
0.377

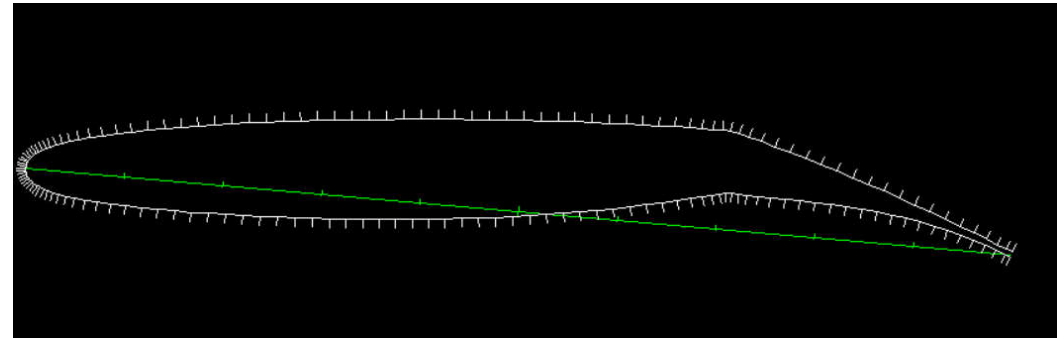
Max camber = 0.067593 at x =
0.706



**Gli angoli di flap assegnati sono incrementali (estendo e rientro)
+5, +10, -10 ; -5**

XFOIL > PANE

XFOIL > PPAR

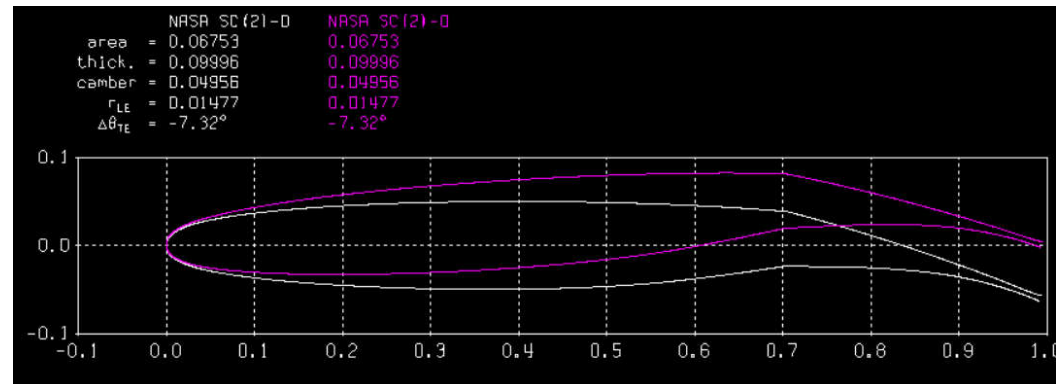


GDES c> dero

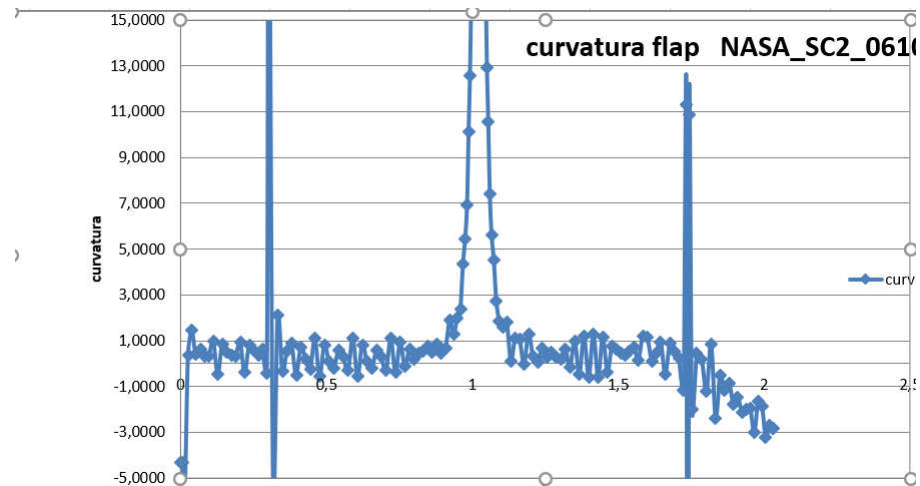
Rotating buffer airfoil by -3.519 deg.

Max thickness = 0.099964 at x = 0.375

Max camber = 0.049556 at x = 0.705



.GDES c> clis
COPIARE DALLA FINESTRA DOS LE CURVATURE
RAPPRESENTARLE LIMITANDO IL GRAFICO TRA 3 E - 3



Aerodinamica del profilo senza e con con flap

Flap a 15°

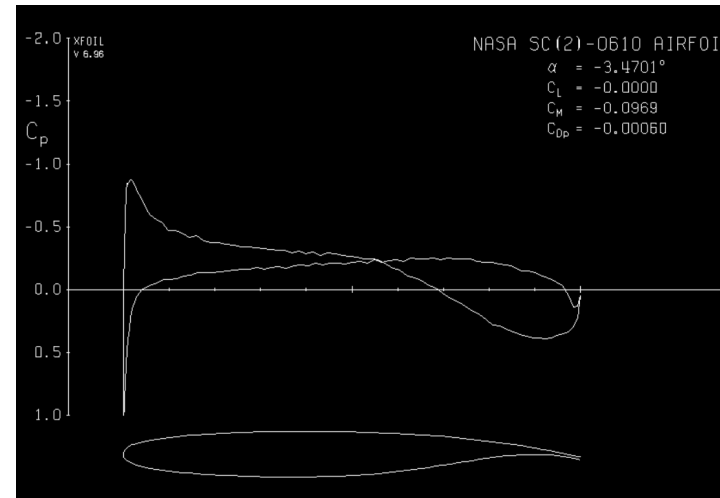
Buffer airfoil is not identical to current airfoil

È necessario ripannellare con la nuova geometria

XFOIL c> pane

XFOIL c> ppar

XFOIL c> gdes

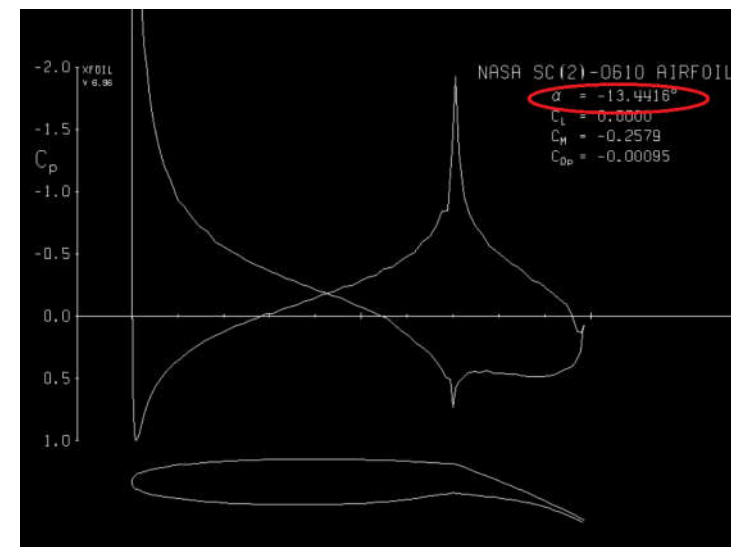


XFOIL c> oper

.OPERi c> cl 0

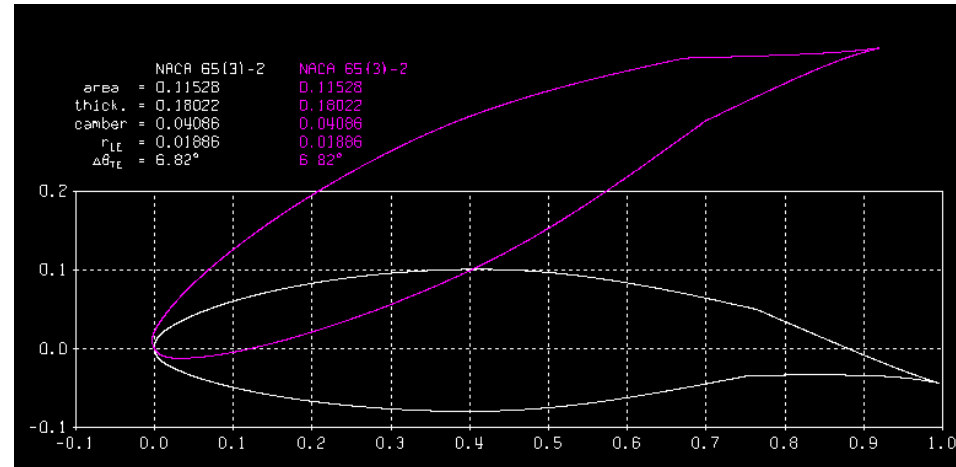
Calculating unit vorticity distributions ...

X-window size changed to 11.00" x -0.85"



MODIFICA DELLA GEOMETRIA (aggiunta di un DROP NOSE)

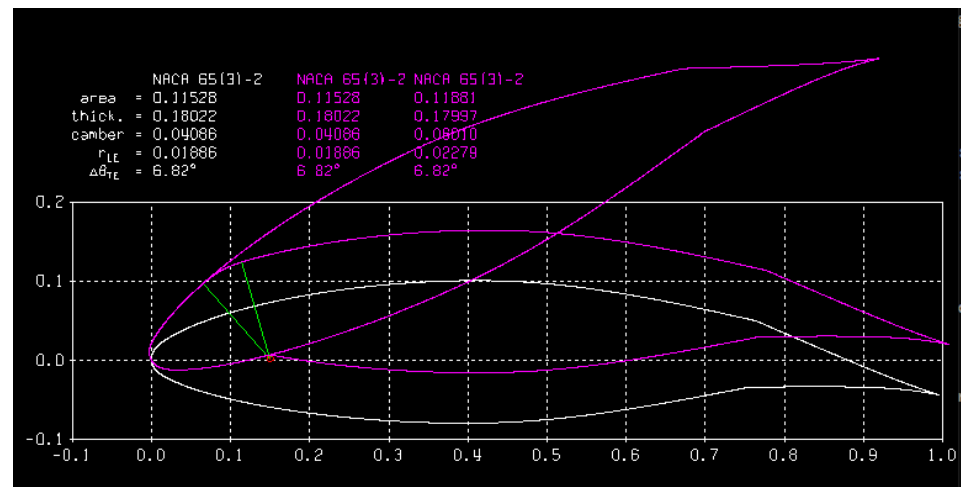
Assegnare ADEG angolo rotazione della geometria
intorno all'origine
.GDES c> adeg
Enter angle change (deg) r> -25



DETERMINARE LE COORDINATE DELLA CERNIERA (in
mezzeria) DEL DROP NOSE

NACA 65(3)-218	
posizione hinge ; x =	0,15
posizione hinge ; y =	0,0212

.GDES c> flap
Enter flap hinge x location r> 0.15
Enter flap hinge y location (or 999 to specify y/t) r> 0.000047
Enter flap deflection in degrees (+ down) r> 25



XFOIL c> pane
XFOIL c> ppar

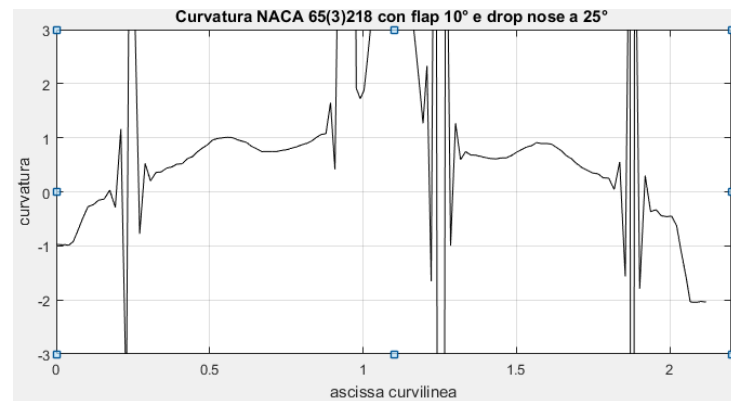
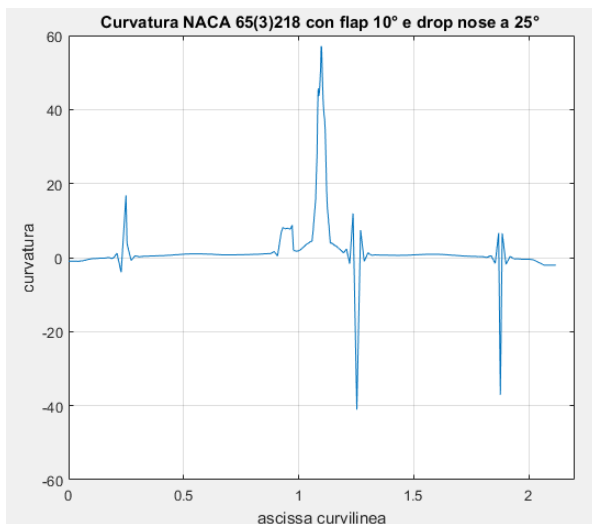
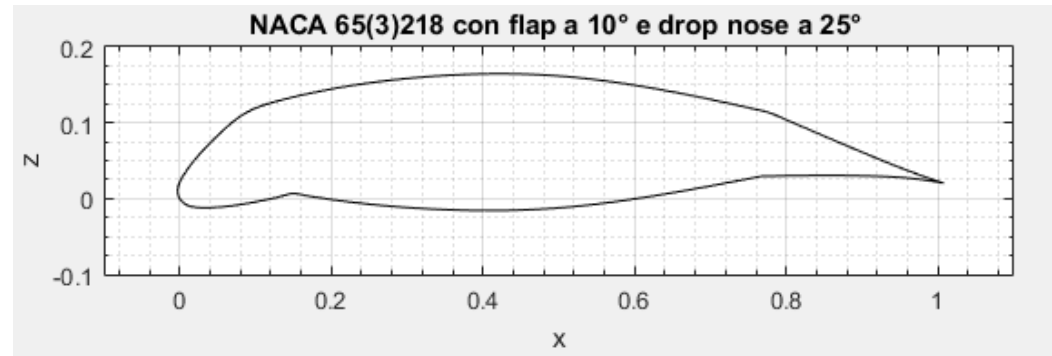
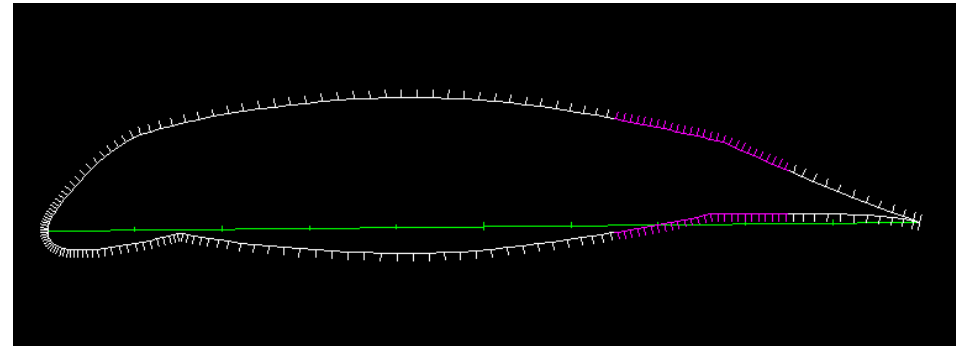
XFOIL c> save naca653218drpflap.txt

XFOIL c> gdes

You are working with the buffer airfoil

Curvature

.GDES c> clis



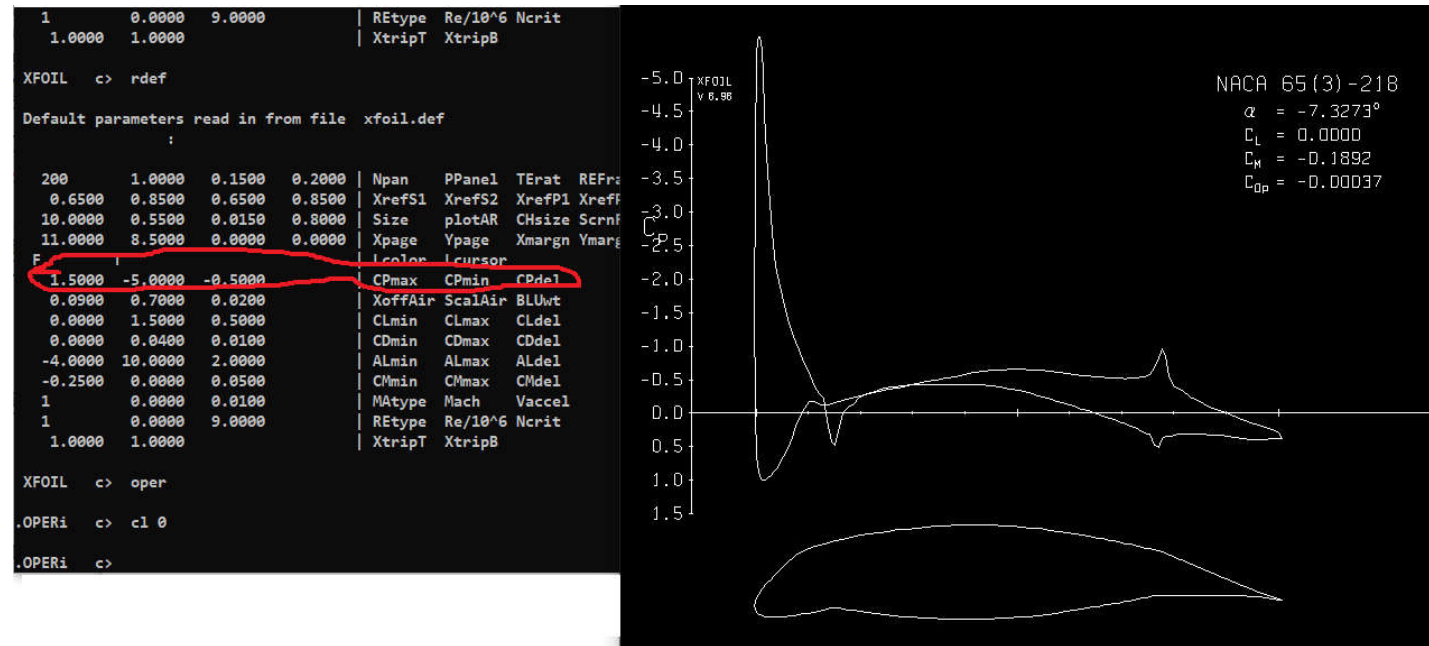
Aerodinamica del profilo con flap e drop nose

XFOIL c> oper

.OPERi c> cl 0

Editare e modificare xfoil.def

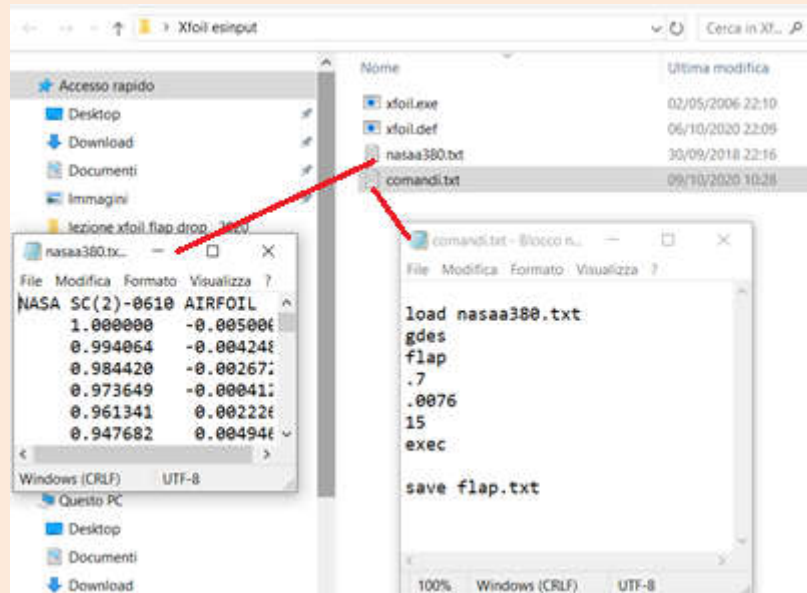
Size per opportuna finestra .



La rappresentazione nella grafica di Xfoil ha richiesto la modifica dell'intervallo di rappresentazione del coefficiente di pressione

Uso in batch di Xfoil

Nella directory DOS di Xfoil costruire un file testo di comandi (ex. comandi .txt) nel quale è elencata la sequenza di comandi che deve essere eseguita da Xfoil .



```
Microsoft Windows [Versione 10.0.18362.1082]
(c) 2019 Microsoft Corporation. Tutti i diritti sono riservati.

C:\Users\prestige>cd desktop
C:\Users\prestige\Desktop>cd Xfoil esinput
C:\Users\prestige\Desktop\Xfoil esinput>dir
Il volume nell'unità C è Windows
Numero di serie del volume: D403-F4BF

Directory di C:\Users\prestige\Desktop\Xfoil esinput
12/10/2020 10:10 <DIR>      .
12/10/2020 10:10 <DIR>      ..
09/10/2020 10:28              73 comandi.txt
30/09/2018 22:16            4.345 nasaa380.txt
06/10/2020 22:09              903 xfoil.def
02/05/2006 22:10        1.339.392 xfoil.exe
                    4 File      1.344.713 byte
                    2 Directory 271.887.929.344 byte disponibili

C:\Users\prestige\Desktop\Xfoil esinput>
```

Nel caso in esame carica la geometria del profilo (presente nella directory) e la modifica inserendo un flap e salvando la nuova geometria nel file 'flap.txt'

Uso in batch di Xfoil (2)

L'esecuzione in batch di xfoili avviene con la seguente istruzione DOS

C:\Users\xxxxxxx\Desktop\Xfoil esinput>**xfoil < comandi.txt**

