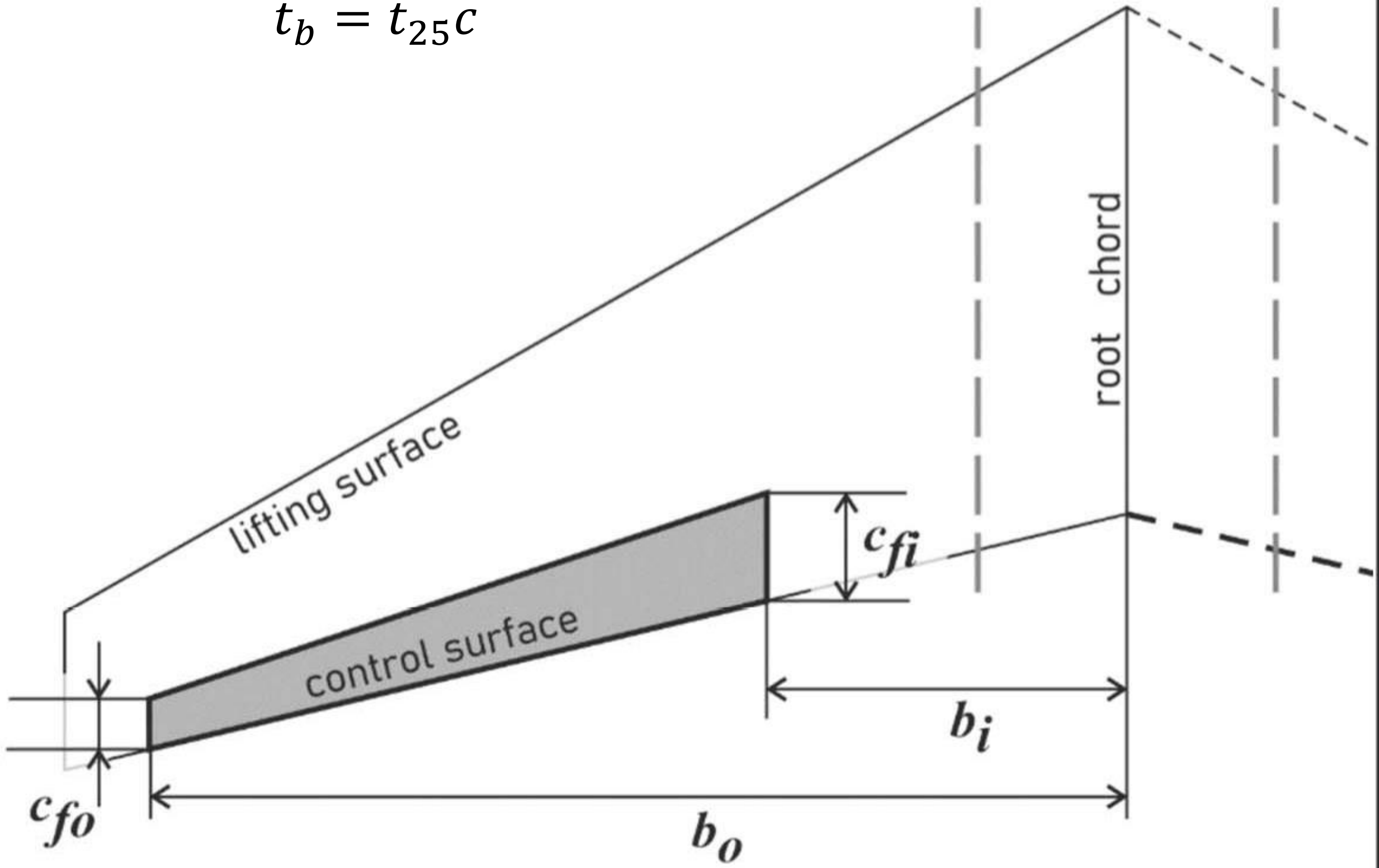
Tutorial Modul 3

Geometri

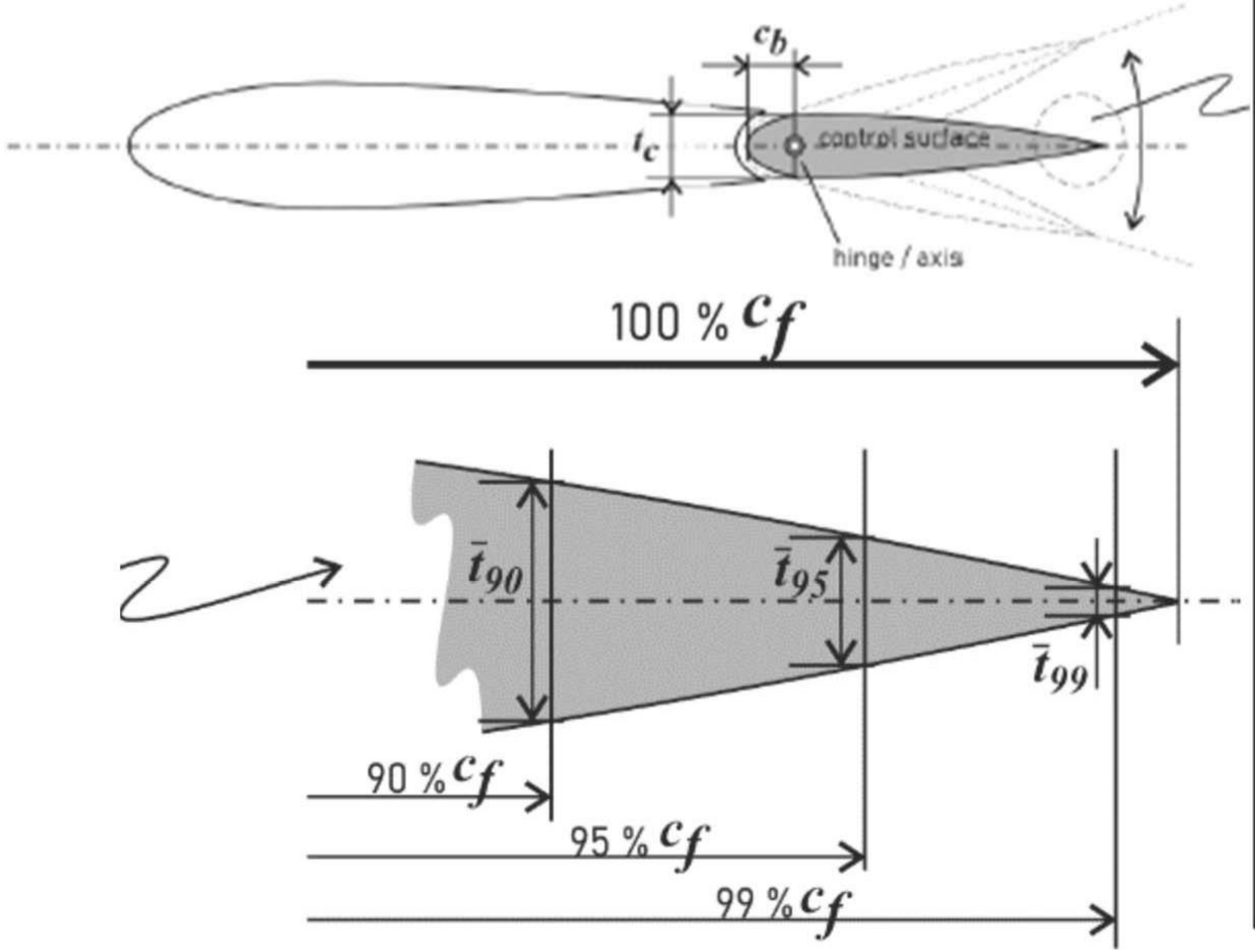
$$c_b = 0.25c$$
$$t_b = \bar{t}_{25}c$$



ELEVATOR	
Chord Inboard (c_{fi}):	[m]
Chord Outboard (c_{fo}):	[m]
Chord rata-rata (c):	[m]
Semispan Inboard (b_{fi}):	[m]
Semispan Outboard (b_{fo}):	[m]
Axis Hor-pos (c_b):	[m]
Tebal airfoil pada pos. axis (t_b):	[m]
Tebal airfoil (per c) pada 90% chord ($\bar{t}_{90}$):	[-]
Tebal airfoil (per c) pada 95% chord ($\bar{t}_{95}$):	[-]
Tebal airfoil (per c) pada 99% chord ($\bar{t}_{99}$):	[-]
Kemiringan profil airfoil antara 90% - 99% →	
$\tan\left(\phi_{TX}/2\right) = \frac{1}{2}\left[\frac{\bar{t}_{90} - \bar{t}_{99}}{0.09}\right]$:	[-]
Kemiringan profil airfoil antara 95% - 99% →	
$\tan\left(\phi_{TX}/2\right) = \frac{1}{2}\left[\frac{\bar{t}_{95} - \bar{t}_{99}}{0.04}\right]$:	[-]

Geometri

Kasus plain flap control surface



ELEVATOR	
Chord Inboard (c_{fi}):	[m]
Chord Outboard (c_{fo}):	[m]
Chord rata-rata (c):	[m]
Semispan Inboard (b_{fi}):	[m]
Semispan Outboard (b_{fo}):	[m]
Axis Hor-pos (c_b):	[m]
Tebal airfoil pada pos. axis (t_b):	[m]
Tebal airfoil (per c) pada 90% chord ($\bar{t}_{90}$):	[-]
Tebal airfoil (per c) pada 95% chord ($\bar{t}_{95}$):	[-]
Tebal airfoil (per c) pada 99% chord ($\bar{t}_{99}$):	[-]
Kemiringan profil airfoil antara 90% - 99% →	
$\tan\left(\phi_{TE}/2\right) = \frac{1}{2}\left[\frac{\bar{t}_{90}-\bar{t}_{99}}{0.09}\right]$:	[-]
Kemiringan profil airfoil antara 95% - 99% →	
$\tan\left(\phi_{TE}/2\right) = \frac{1}{2}\left[\frac{\bar{t}_{95}-\bar{t}_{99}}{0.04}\right]$:	[-]

Definisi ketebalan pada % chord tertentu.

Diperlukan pengukuran ketebalan airfoil pada 90%, 95%, dan 99%.

Cek http://airfoiltools.com/airfoil/

	X	Y UPPER	Y LOWER
1	0.000	0.0000	0.0000
2	0.002	0.0069	-0.0069
3	0.006	0.0135	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
12	0.175	0.0557	-0.0557
13	0.206	0.0577	-0.0577
14	0.239	0.0591	-0.0591
15	0.250	0.0593	-0.0593
16	0.273	0.0598	-0.0598
17	0.309	0.0600	-0.0600
18	0.345	0.0596	[illegible]
[illegible]	[illegible]	[illegible]	-0.0235
32	0.854	0.0201	-0.0201
33	0.880	0.0169	-0.0169
34	0.900	0.0145	-0.0145
35	0.905	0.0139	-0.0139
36	0.926	0.0111	-0.0111
37	0.946	0.0087	-0.0087
38	0.950	0.0081	-0.0081
39	0.962	0.0065	-0.0065
40	0.976	0.0046	-0.0046
41	0.986	0.0032	-0.0032
42	0.990	0.0027	-0.0027
43	0.994	0.0021	-0.0021
44	0.998	0.0013	-0.0015
45	0.998	0.0015	-0.0013

$\bar{t}_{25} = 0.0593 - (-0.0593) = 0.1186$

$\bar{t}_{90} = 0.0145 - (-0.0145) = 0.029$

$\bar{t}_{95} = 0.0081 - (-0.0081) = 0.0162$

$\bar{t}_{99} = 0.0027 - (-0.0027) = 0.0054$

Not secure | airfoiltools.com/airfoil/details?airfoil=n2414-il

Airfoil Tools

Search 1638 airfoils

Tweet

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

ENHANCED BY Google 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

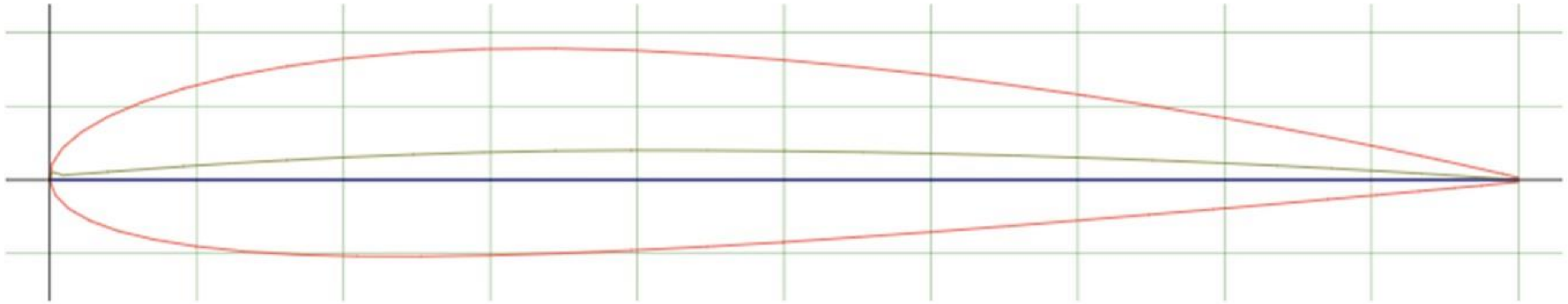
Symmetrical airfoils
NACA 4 digit airfoils
NACA 5 digit airfoils
NACA 6 series airfoils

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)
J j5012 to joukowsk0021 (7)
K k1 to kenmar (11)
L l1003 to lwk80150k25 (24)
M m1 to mue139 (95)
N n0009sm to nplx (174)
O oa206 to oaf139 (9)
P p51droot to pw98mod (16)

NACA 2414 (n2414-il)

NACA 2414 - NACA 2414 airfoil



Details

(n2414-il) NACA 2414
NACA 2414 airfoil
Max thickness 14% at 29.5% chord.
Max camber 2% at 39.6% chord
Source UIUC Airfoil Coordinates Database
Source dat file
The dat file is in Selig format

Dat file

```
NACA 2414
 1.00000  0.00147
 0.99739  0.00210
 0.98929  0.00396
 0.97587  0.00700
 0.95729  0.01112
```

Parser

No parser warnings

Send to airfoil plotter
Add to comparison
Lednicer format dat file
Selig format dat file

Similar airfoils

S2027	Preview	Details
GOE 629 AIRFOIL	Preview	Details
AVISTAR	Preview	Details
GOE 617 AIRFOIL	Preview	Details
NACA 2415	Preview	Details
NACA 2415	Preview	Details
GOE 704 AIRFOIL	Preview	Details

NACA 2414

X	Y UPPER	X	Y LOWER
1.000000	0.001470	0.000000	0.000000
0.997390	0.002100	0.003790	-0.010310
0.989290	0.003960	0.012930	-0.019560
0.975870	0.007000	0.027300	-0.027700
0.957290	0.011120	0.046690	-0.034710
0.933720	0.016200	0.070870	-0.040540
0.905420	0.022070	0.099570	-0.045160
0.872670	0.028570	0.132460	-0.048580
0.835820	0.035520	0.169180	-0.050820
0.795270	0.042740	0.209370	-0.051950
0.751430	0.050040	0.252600	-0.052080
0.704800	0.057230	0.298440	-0.051330
0.655860	0.064120	0.346440	-0.049870
0.605150	0.070530	0.396110	-0.047870
0.553240	0.076290	0.447390	-0.045370
0.500690	0.081200	0.499310	-0.042320
0.448080	0.085120	0.551290	-0.038860
0.395980	0.087870	0.602760	-0.035160
0.344540	0.089130	0.653160	-0.031320
0.294820	0.088660	0.701940	-0.027450
0.247400	0.086450	0.748570	-0.023650
0.202850	0.082550	0.792520	-0.019980
0.161690	0.077070	0.833310	-0.016500
0.124400	0.070140	0.870480	-0.013280
0.091410	0.061980	0.903600	-0.010350
0.063100	0.052810	0.932300	-0.007760
0.039770	0.042890	0.956260	-0.005570
0.021650	0.032450	0.975180	-0.003810
0.008920	0.021710	0.988860	-0.002520
0.001690	0.010850	0.997130	-0.001730
0.000000	0.000000	1.000000	-0.001470

Axis Hor-pos (C_b): [m]

Tebal airfoil pada pos. axis (t_b): [m]

Tebal airfoil (per C) pada 90% chord ($\bar{t}_{90}$): [-]

Tebal airfoil (per C) pada 95% chord ($\bar{t}_{95}$): [-]

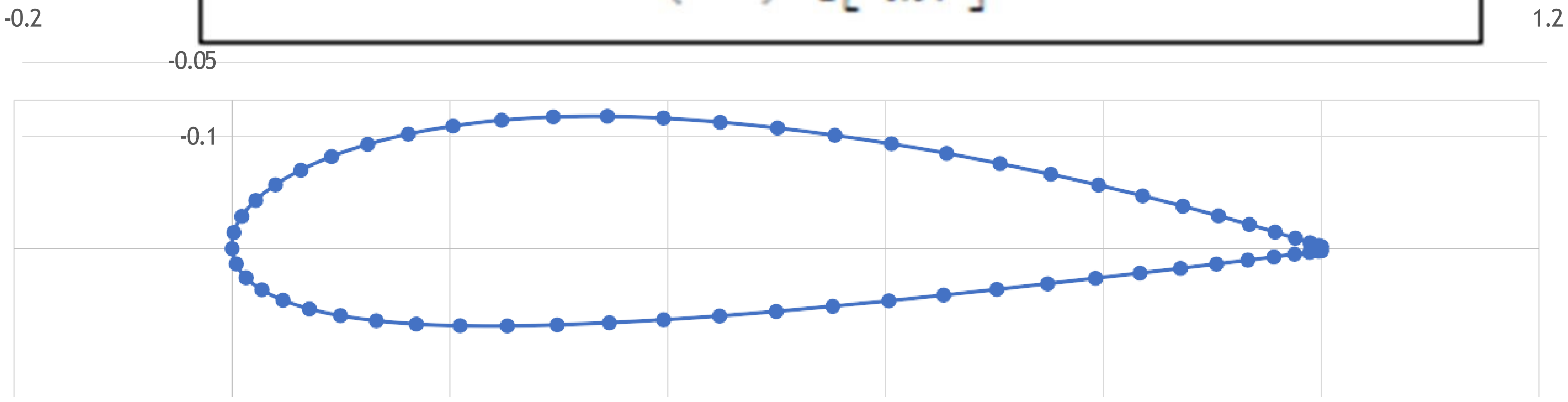
Tebal airfoil (per C) pada 99% chord ($\bar{t}_{99}$): [-]

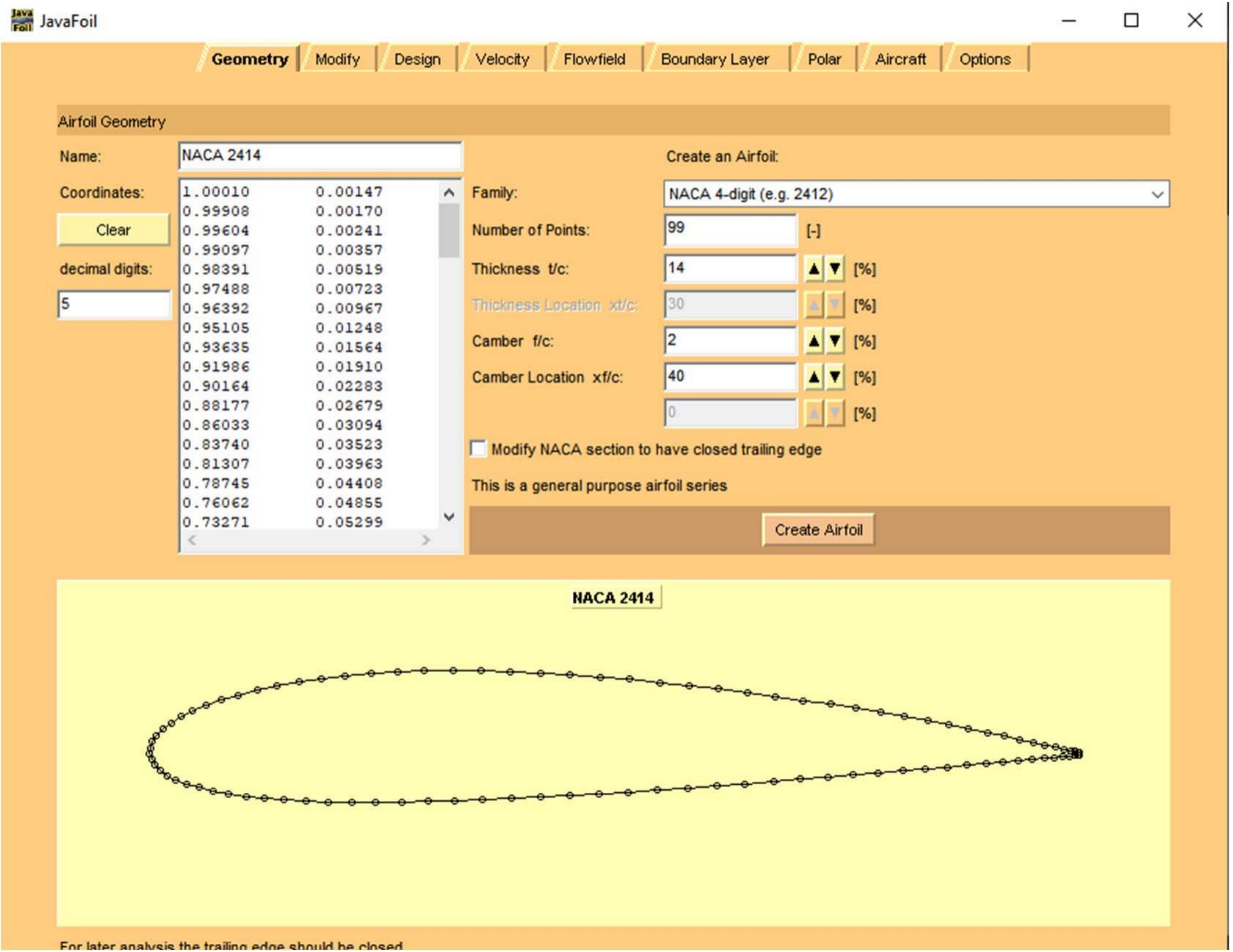
Kemiringan profil airfoil antara 90% - 99% →

$$\tan\left(\phi_{TX}/2\right) = \frac{1}{2}\left[\frac{\bar{t}_{90}-\bar{t}_{99}}{0.09}\right]: \quad [-]$$

Kemiringan profil airfoil antara 95% - 99% →

$$\tan\left(\phi_{TX}/2\right) = \frac{1}{2}\left[\frac{\bar{t}_{95}-\bar{t}_{99}}{0.04}\right]: \quad [-]$$





JavaFoil
Geometry
Modify
Design
Velocity
Flowfield
Boundary Layer
Polar
Aircraft
Options
Airfoil Geometry
Name:
NACA 2414
Coordinates:
Clear
decimal digits:
5
1.00010 0.00147
0.99908 0.00170
0.99604 0.00241
0.99097 0.00357
0.98391 0.00519
0.97488 0.00723
0.96392 0.00967
0.95105 0.01248
0.93635 0.01564
0.91986 0.01910
0.90164 0.02283
0.88177 0.02679
0.86033 0.03094
0.83740 0.03523
0.81307 0.03963
0.78745 0.04408
0.76062 0.04855
0.73271 0.05299
Create an Airfoil:
Family:
NACA 4-digit (e.g. 2412)
Number of Points:
99
[-]
Thickness t/c:
14
[%]
Thickness Location xt/c:
30
[%]
Camber f/c:
2
[%]
Camber Location xf/c:
40
[%]
0
[%]
Modify NACA section to have closed trailing edge
This is a general purpose airfoil series
Create Airfoil
NACA 2414
For later analysis the trailing edge should be closed

DEMO DATCOM

[$SYMFLP Namelist]

<table>
<tr><th>Kode</th><th>Keterangan</th></tr>
<tr><td><pre>…
$SYMFLP
  CHRDFI=1.94,
  CHRDFO=0.73,
  SPANFI=1.15,
  SPANFO=10.33,
  CB=0.33,
  TC=0.16,
  PHETE=0.13,
  PHETEP=0.14,
  FTYPE=1.0,
  NTYPE=1.0,
  NDELTA=9.0,
  DELTA=-20.0,-15.0,-10.0,-5.0,0.0,
  5.0,10.0,15.0,20.0$
…</pre></td><td>➢ Namelist Symmetric Flap
➢ Chord inboard bidang kendali
➢ Chord outboard bidang kendali
➢ Semispan chord inboard bidang kendali
➢ Semispan chord outboard bidang kendali
➢ Posisi horizontal sumbu putar bidang kendali
➢ Tebal profil airfoil pada posisi sumbu putar
➢ Kemiringan profil airfoil (90% -99%)
➢ Kemiringan profil airfoil (95% -99%)
➢ Tipe bidang kendali
➢ Bentuk leading edge bidang kendali
➢ Jumlah sudut defleksi yang akan dihitung
➢ Sudut deflekti yang akan dihitung</td></tr>
</table>

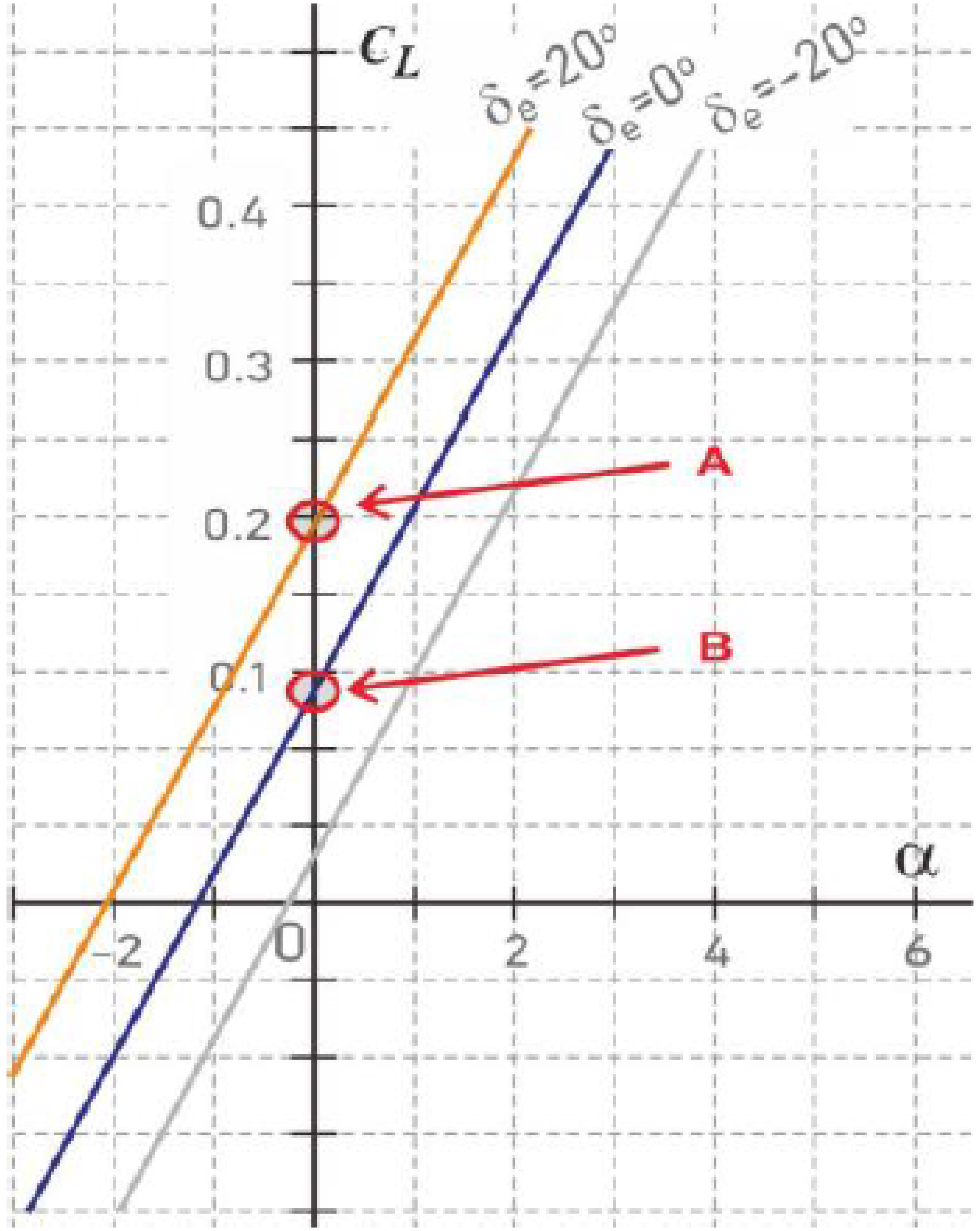
Cek table pada bagian pengukuran geometri bidang kendali untuk mengisi nilai variabel

Output untuk $SYMFLP

```
1                             AUTOMATED STABILITY AND CONTROL METHODS PER APRIL 1976 VERSION OF DATCOM
                                          CHARACTERISTICS OF HIGH LIFT AND CONTROL DEVICES
                                             TAIL PLAIN TRAILING-EDGE FLAP CONFIGURATION
                                                           B777kw_13601011
 -----------------------  FLIGHT CONDITIONS  ------------------------           --------------  REFERENCE DIMI
---
  MACH     ALTITUDE   VELOCITY    PRESSURE    TEMPERATURE     REYNOLDS                REF.      REFERENCE LENGTH
CENTER
 NUMBER                                                        NUMBER                 AREA        LONG.      LAT.
              M         M/SEC      N/ M**2        DEG K         1/ M                  M**2          M          M
0 0.800   11000.00     236.10   9.9016E+00     702.344      5.6004E+05              418.800       8.127     60.000
0.000
0             ---------INCREMENTS DUE TO DEFLECTION---------                    ---DERIVATIVES (PER DEGREE)---
0      DELTA     D(CL)      D(CM)     D(CL MAX)    D(CD MIN)                     (CLA)D      (CH)A        (CH)D


      -20.0    -0.086     0.3888      0.084       0.00536                       NDM      -2.933E-03  -7.526E-03
      -15.0    -0.078     0.3490      0.068       0.00332                       NDM                  -7.297E-03
      -10.0    -0.053     0.2386      0.049       0.00146                       NDM                  -7.263E-03
       -5.0    -0.027     0.1194      0.025       0.00069                       NDM                  -7.263E-03
        0.0     0.000    -0.0002      0.000       0.00000                       NDM                  -7.263E-03
        5.0     0.027    -0.1194      0.025       0.00069                       NDM                  -7.263E-03
       10.0     0.053    -0.2386      0.049       0.00146                       NDM                  -7.263E-03
       15.0     0.078    -0.3490      0.068       0.00332                       NDM                  -7.297E-03
       20.0     0.086    -0.3903      0.084       0.00536                       NDM                  -7.526E-03
```

D(variable), eg: D(CL), mengindikasikan penambahan niai (increment) untuk koefisien aero terkait untuk nilai defleksi (DELTA) tertentu.



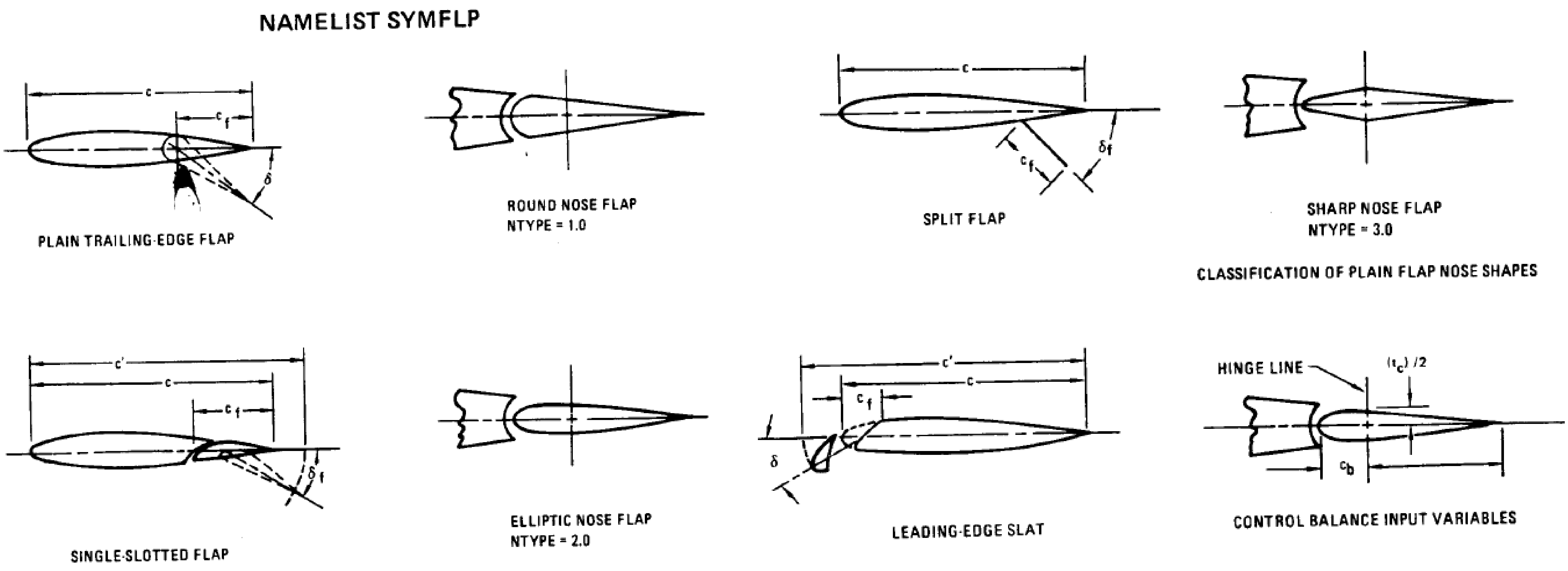
Poin **A** saat α = 0°, dan δ_e = 20°, Poin **B** saat α = 0°, dan δ_e = 0°, maka

$$C_{L_{\delta e}} = \frac{0.208 - 0.112}{20^o - 0^o} = 0.0043\,/^o$$

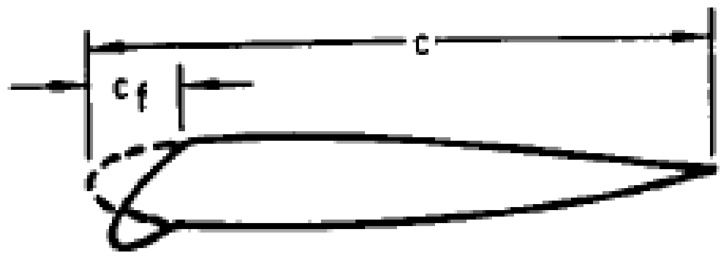
(Koefisien kendali elevator (***C_L*** dan ***C_m***) pada umumnya konstan terhadap α dan δ_e). Dan efek elevator pada ***C_D*** umumnya mendekati nol

Lakukan yang sama dengan grafik/data **C_D** dan **C_m**

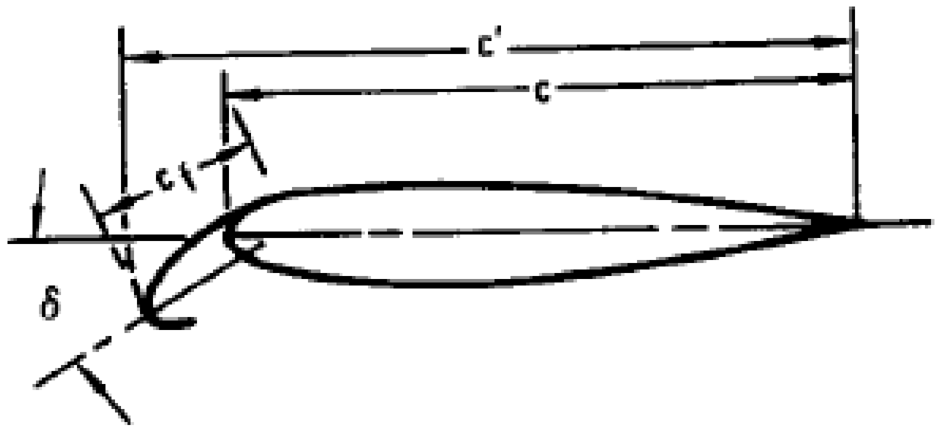
Tipe Flap untuk $SYMFLP



Tipe Flap untuk $SYMFLP



LEADING-EDGE-FLAP



KRUEGER FLAP

NAMELIST SYMFLP

Synnetrical Flap Deflection

Variable Name	Dim	Definition	p.57 Units
CHRDFI		flap chord at inboard edge of plain flap aileron,	
		measured parallel to longitudinal axis	
CHRDFO		flap chord at outboard edge of plain flap aileron,	
		measured parallel to longitudinal axis	
SPANFI		span location of of inboard edge of flap or spoiler control	
		measured perpendicular to the vertical plane of symmetry	
SPANFO		span location of of outboard edge of flap or spoiler control	
		measured perpendicular to the vertical plane of symmetry	
NDELTA		number of control deflection angles; required for all	
		controls, max of 9	
PHETEP		tangent of airfoil trailing edge angle based on	
		ordinates at x/c=0.95 and 0.99	
PHETE		tangent of airfoil trailing edge angle based on	
		ordinates at x/c=0.90 and 0.99	
FTYPE		=1 plain flaps	
		=2 single slotted flaps	
		=3 fowler flaps	
		=4 double slotted flaps	
		=5 split flaps	
		=6 leading edge flap	
		=7 trailing edge flap	
		=8 Krueger	
NTYPE		nose type	
		=1 round nose flap	
		=2 elliptical nose flap	
		=3 sharp nose flap	
SCHA			
CB		average chord of the balance	
TC		average thickness of the control at the hinge line	
SCHD			
DELTA		flap deflection angle measured streamwise	
CPRMEI		total wing chord at inboard edge of flap	
CPRMEO		total wing chord at outboard edge of flap	
SCLD		increment in section lift coefficient	
SCMD		increment in section pitching moment coefficient	
CMU		two dimensional jet efflux coefficient	
DELJET		jet deflection angle	
JETFLP		=1 pure jet flap	
		=2 internally blown flap	
		=3 externally blown flap	
		=4 combination mechanical and pure jet flap	
EFFJET		EBF effective jet deflection angle	
CAPINB			
CAPOUT			
DOBDEF			