ATTENTION!

This Page Is the Cover Page of Your Project, Do Not Put Anything Before this Page

MEEN-414-646 Elements of Turbomachinery , Module M 2

Design of Subsonic Turbine M2-T and Compressor Blades M2-C

No. of students involved: 2 for 1 for M-2T and 1 for M-2C
Student 1: Last Name, Initial
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M-2T Subsonic Turbine Blade Design Instruction

For the turbine design project, develop a design software that enables you to generate subsonic turbine blades.

1) Read Chapter 10, turbine and compressor part, **you may omit the conformal transformation part**.
2) Generate a family of profiles that have $\alpha_1 = 90^o$, $\alpha_2 = 160^o$, $\alpha_1 = 45^o$, $\alpha_2 = 160^o$,
3) Superpose the turbine base profile on the camber using the code you already developed

To design subsonic turbine blades, a step-by-step design procedure is given, see also Fig. 1
Step1

1) Draw two parallel lines that are apart by an axial chord.
2) Choose an axial chord C_{ax} of any length you wish.
3) Draw at 1/3 of the C_{ax} a parallel line to the cascade front.
4) Draw the inlet flow velocity vector with the given angle α_1 and intersect it with the 1/3 line.
5) At the point of intersection draw exit velocity vector line at an angle α_2.
6) Intersect the above line with the cascade rear front line.
7) Connect the front intersect with the rear, you find the stagger angle γ
8) With the tangent at inlet and exit as Fig 1. Construct the camberline using **Bezier function** as detailed in Chapter 10. You may use instead of 1/3 a one half distance (item 3)
9) Once you have the camberline, superimpose the base profile as detailed in Chapter 10. The base profile is in ***ecampus*** as a data file.

Step 2: Manual design of camber line

1) Divide segment A and B into equal segments as shown in Fig.1.
2) Connect the point 2 of A with point n-1 of B, 3 with n-2, etc to design a camber envelope.
3) Tangent the camber to the envelope.
4) You may curve fit the camber or extract discrete points.
5) Use the camber in conjunction with a given base line. Use the superposition principle, Chap 10 .

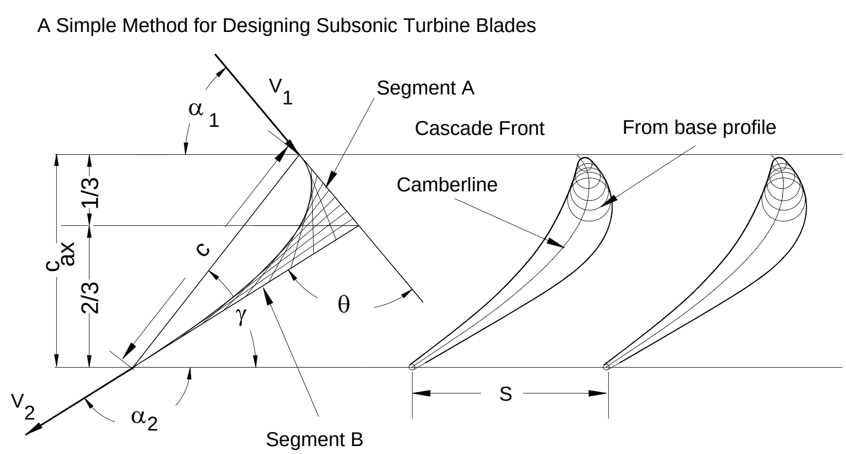

Figure 1

MEEN-414-646- Elements of Turbomachinery, Module 2
M2C- Design of Compressor Blades

M2C Module: Subsonic Compressor Design Using NACA Camberline Equation

For the compressor design project, develop a design software that enables you to generate NACA compressor blade profiles

1) Read Chapter 10
2) Follow instructions and arrive at the equation for blade camber line for compressor
3) For compressor blades, the higher the blade camber height, the higher is the lift coefficient Cl
   Vary Cl from 0 to 1.0 to get a feeling about the camber.
4) Superimpose the following base profile and get the compressor blade
5) Further instruction will be given to you in the class.

For generation of suction and pressure side you may spline function or any other interpolation function.

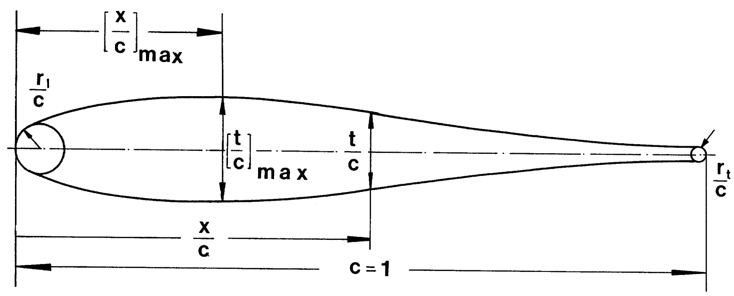

Figure 2: Base profile

$[x/c]_{max\%}$	5	10	15	20	25	30	35	40	45	50
$[t/c]_{max\%}$	8.4	11.1	13.0	14.4	14.9	15.0	14.4	13.5	12.4	11.2
$[x/c]_{max\%}$	55	60	65	70	75	80	85	90	95	100
$[t/c]_{max\%}$	10.1	8.9	7.7	6.7	5.7	4.7	3.8	3.0	2.1	0.0

Also: The following base profile generated by Joukosky transformation will be inserted into a special folder in ***ecampus*** that you have access to. Once you have the file take Column 1 and 2 only.

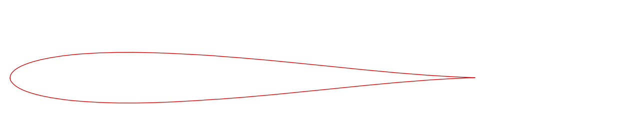

Figure 3: Base profile generated by conformal transformation