Implementation

# Task

**Create a wing-profile generator program that is also capable for creating simplified mesh for the generated geometry.**

On the consultation we agreed, that representing the wing geometry as points in 3D is sufficient, and that the user should be able to give proportions of the end and start of the wing, so the program could generate the leading and trailing edges of the wing.

# Introduction

I chose the NACA 4-digit wing profile for the base of implementation. There are of course much more complex profile describing models, but I thought this will be enough for this example, because it does not require too much explanation, and it provides nice results.

## NACA 4

The NACA-4 defines the wing with the following three parameters

* The first digit describes the maximum the maximum camber as percentage of the chord[[1]](#footnote-1).
* The second digit gives the distance of the maximum camber from the leading edge in tens of percents of the chord.
* The last two digits describe the maximum thickness of the wing as percent of the chord.

So the NACA 4410 airfoil’s parameters as percentages of the chord:

* **Camber:** 4%
* **Max camber location:** 40%
* **Maximum thickness:** 10%

## Used Technology

### MATLAB

For the realization of this wing profile I used MATLAB numerical computing programming language and environment, for the calculations, and its App Designer feature, to implement the user interface.

### GIT

I used Git version control system, to back up my development, so I don’t lose my progress in case of a hardware failure, and also I can easily revert to a previous state, if I took a wrong turn in the development.

# Implementation

I planned to do an application with a user interface, where the user can give the NACA parameters and the wing start-end proportions, and after pressing a button, the application plots of the profile, the edge, and the profile combined with the edge in 3D.

For starters, I developed in simple MATLAB scripts, I left the App Designer for later, when I had the calculations and plots figured out. First I implemented the calculations for the NACA profile. For this, the following equations were needed.

**Half thickness of the wing**

* **y** is the half thickness at a given **x** value.
* **x** is the position along the chord from 0 to 1.
* **t** is the maximum thickness, coming from the last two digits of the NACA 4-digit model

**Mean camber**

* **yc** is the camber at a given **x** value
* **m** is the maximum camber
* **p** is the location of the maximum camber

**Location of upper and lower points of the profile**

1. In aeronautics, a chord is the imaginary straight line joining the leading and trailing edges of an aerofoil. [↑](#footnote-ref-1)