User Guide for the Diederich Method Excel-File

The following instructions are a compact view over the use and understanding of the Diederich Method Excel-file. This teaching tool can be used to calculate lift distributions for straight tapered swept wings. In addition several other values, useful for aircraft design purposes, can be determined. For in depth understanding of the calculation, read through the pages 467-476 in *Synthesis of Subsonic Airplane Design* by Egbert Torenbeek (available from: https://bit.ly/3m8KIIV).

The Main Page

The main page basically covers all you need for working with the Excel-file. The input fields in blue and the output fields in green are placed on the left side. The diagram in the middle is divided into two areas. The upper area shows the lift distributions over a half span. The curves are assigned by name in the legend, located on the right of the diagram. Below the lift distributions there is a visualization of the half span corresponding to the parameters stated in the input. On the right side there is a "How to use" field which covers the most important guidelines and is to be used additionally to this user guide. Plot tables are available at the bottom of the main and any other page, where they can be visited if necessary.

The Input

The input is divided in two sections. The **General Input** is the input with the most affecting parameters on the displayed diagrams. The restrictions for the general input are stated in the "How to use" guide on the right and therefore not mentioned furthermore. The **Additional Input** covers the airfoil and atmosphere data and gives an opportunity to differentiate between different airfoils for the tip and for the root chord. If the airfoil data is not given, see *Theory of Wing Sections* by Abbott and Doenhoff from 1959. The definition of the trailing edge angle of the airfoil is given in Figure 1 on the next page. The airfoil for the default setup of the additional input is taken from NACA 63_2-615, also listed in *Theory of Wing Sections* by Abbott and Doenhoff. For determining the correct airfoil data, the Reynolds number is given in the output section for the chosen flight altitude and the chosen mean chord length. Note: To perform the calculations, it is not necessary to know the type of airfoil. It is sufficient to know (or to guess) the numbers.

The Output

The Output is divided into three sections. The **Comparison Output** shows the deviations between the calculated lift distribution for the chosen wing and the comparative distributions. The elliptic distribution stands for minimum induced drag while the triangular distribution provides a relatively small root bending moment. The Mason-Curve is something in between and combines both benefits to an optimum distribution. The distribution with the smallest number stated has the most similarity to your calculated distribution and therefore indicates the given characteristics. The **Additional Output** provides the intermediate and additional results that are potentially of interest to the user. The **Calculated Values Output** shows numerous intermediate results of the calculation of the lift distributions in a bundled manner. Results can be tracked here, and, in the case of manual calculation, these are available to the user. Most of these results can also be found in the additional worksheets with the respective product graphs.

The Additional Worksheets

The additional worksheets are only for the more interested users and include the individual sub-areas of the calculation of the lift distributions and therefore give brief insights into the topic. For a full understanding, the literature mentioned in the beginning should be noted.
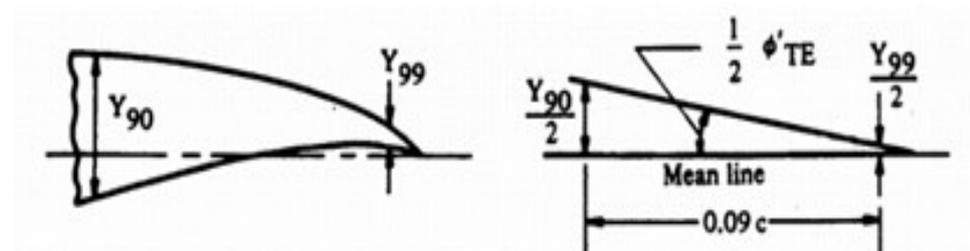

Figure 1   Definition of the trailing edge angle of the airfoil φ'_{TE}
(Hoak, D.E.: *USAF Stability and Control Datcom*)