BladeComp user manual

Introduction

BladeComp is a software program used for the design and analysis of composite rotor blades for wind turbines, helicopters, and other rotating machinery. It provides an integrated environment for designing composite structures, analysing their performance under various loading conditions, and optimising their properties for maximum efficiency and durability. BladeComp is designed to help engineers and designers make informed decisions about the design and manufacture of composite rotor blades, considering factors such as material properties, manufacturing processes, and structural performance. Its intuitive user interface and powerful analysis tools make it easy to create accurate models, simulate various loading scenarios, and interpret the results of complex simulations.

BladeComp is widely used in the wind energy industry for designing and analysing wind turbine blades, as well as in other industries that require the use of composite materials in rotating machinery. Its advanced features and capabilities make it a valuable tool for anyone involved in the design and analysis of composite structures.

Purpose and scope of the user manual

Purpose:

The purpose of this user manual is to provide comprehensive guidance in the form of tutorials to users on how to effectively and efficiently use the BladeComp software. This manual is designed to assist users of all skill levels, from beginners to advanced users, to successfully operate the software and carry out the necessary tasks to accomplish their objectives.

Scope:

This user manual covers the following topics:

Installation guide: This section provides step-by-step instructions for installing BladeComp on your computer.

User interface: This section describes the user interface of BladeComp and its various components, including menus, toolbars, and dialogue boxes.

Getting started: This section covers the basic operations of BladeComp, including creating a new project, importing data, and setting up a simulation.

Simulation and analysis: This section explains how to perform simulations and analyses in BladeComp, including creating a model, setting up materials and properties, and defining boundary conditions.

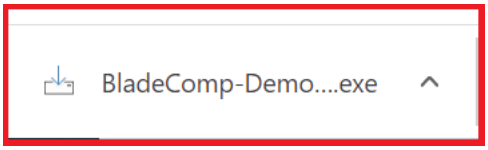
Results interpretation: This section covers how to interpret the results of simulations and analyses in BladeComp, including visualising results, exporting data, and generating reports.

Note: This user manual is intended to serve as a guide for using the BladeComp software and is not a substitute for training or experience in using the software.

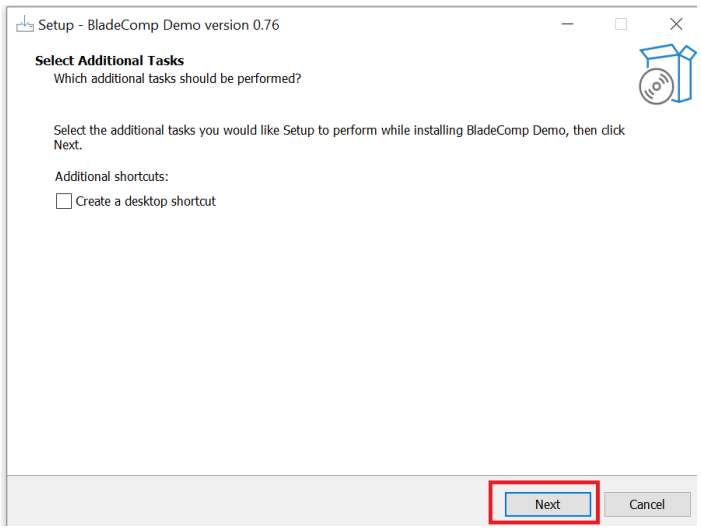
BladeComp software downloading guide

1. Open a web browser and go to https://www.universityofgalway.ie/structures/bladecomp/; Click on the highlighted tab to download the setup.

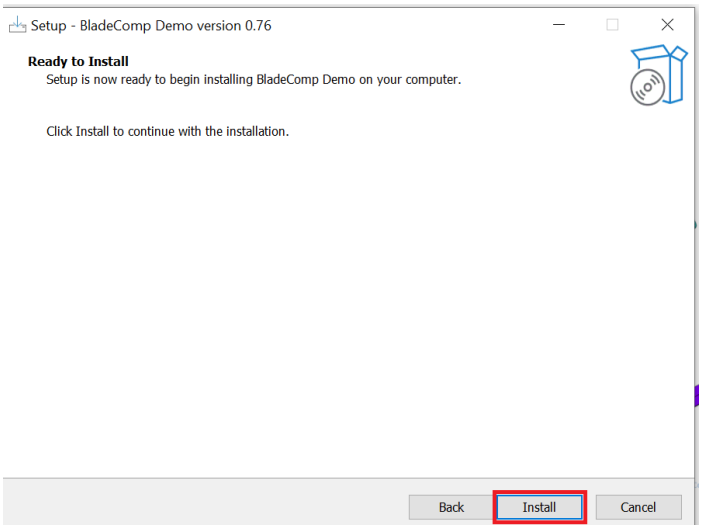
2. When the file has been downloaded, click on it once to start the installation



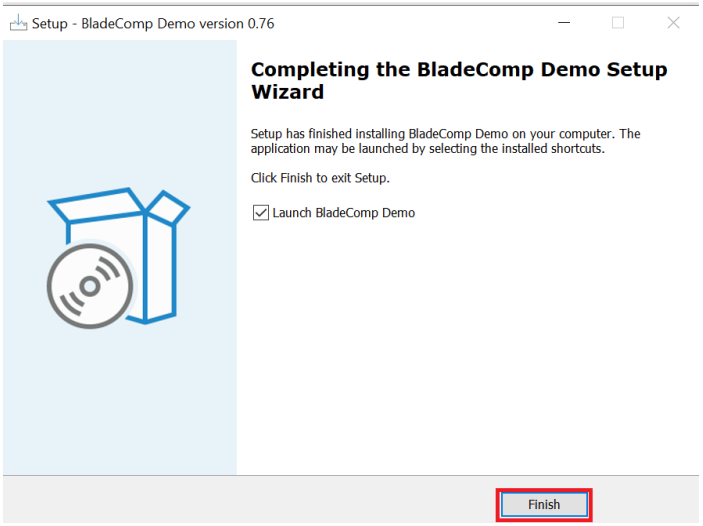
3. At the BladeComp installer screen, click Next



4. Click Install to process



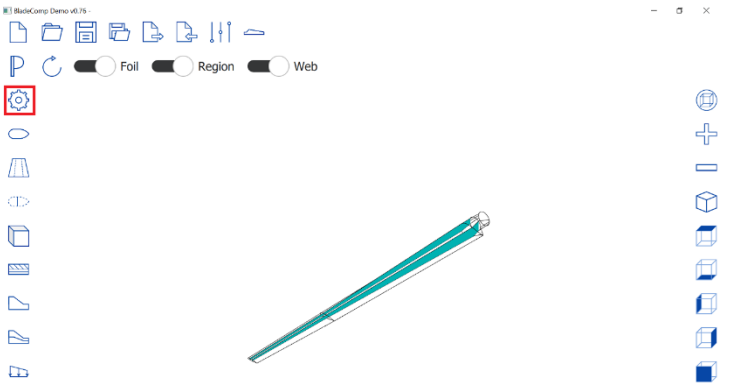
5. Click Finish to complete the installation



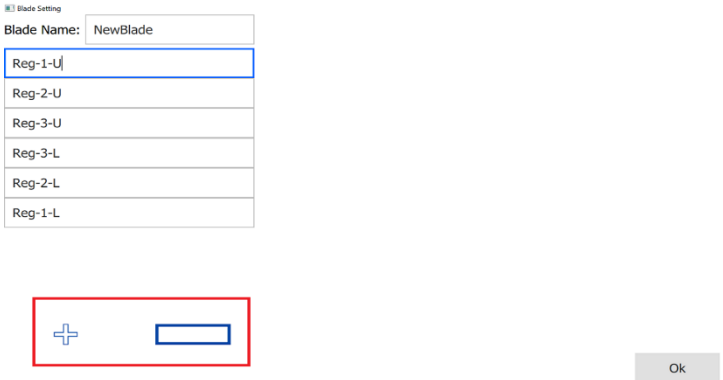
Tutorial for 13 meter long wind turbine blade using limited regions

1. First window after opening the BladeComp software looks like this:

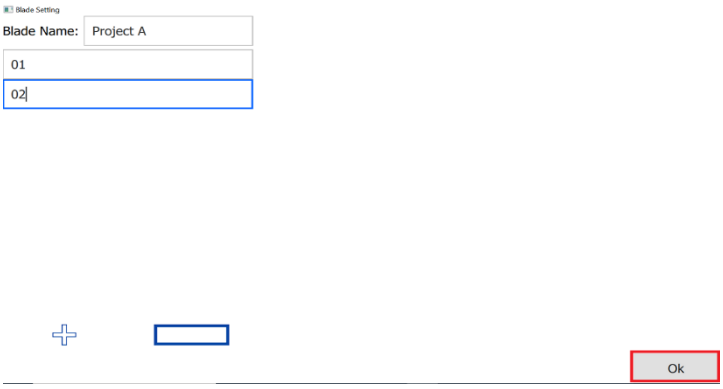
2. To select the number of regions for the blade, go to the setting option



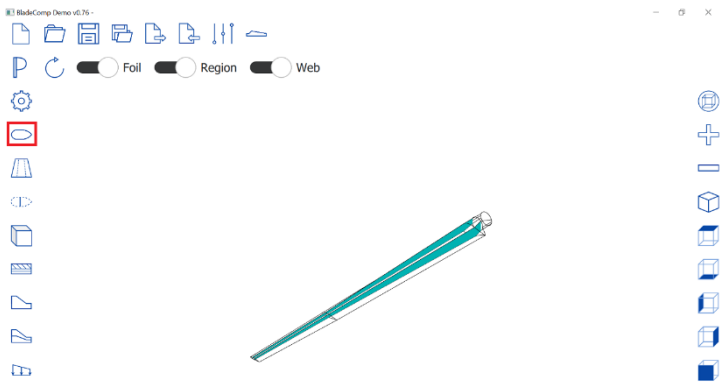
3. The below window will appear after clicking on the setting tab. The regions can be added and subtracted based on the requirements by using the highlighted tab. The Blade name and the name of the regions are also editable.



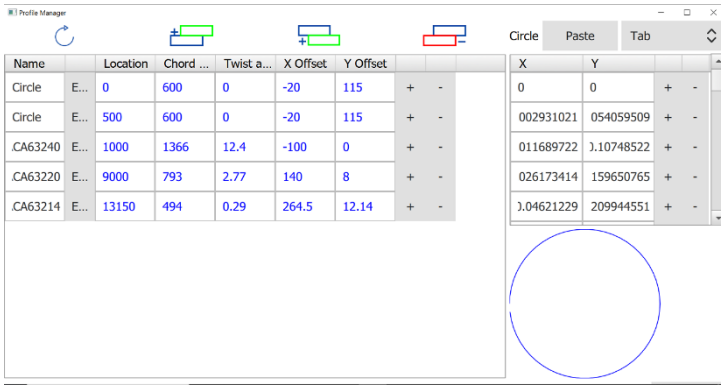
4. Two regions have been taken/selected with names ‘01’ and ‘02’ while, re-named the Blade Name as ‘Project A’ for this tutorial, and click Ok.



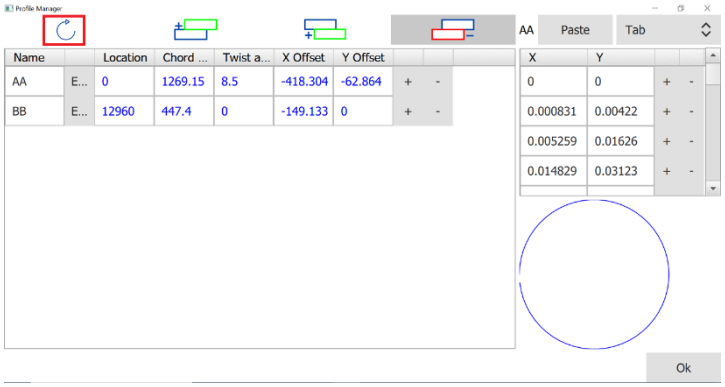
5. To adjust the geometric shape of the blade, such as dimensions, twists, and offsets, click on the ‘profile manager’ tab.



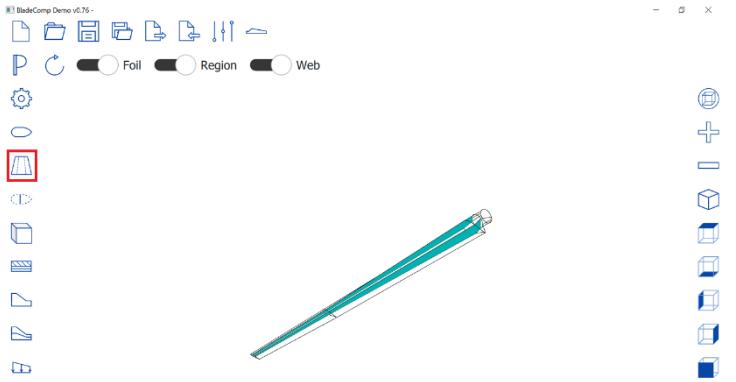
6. The below window will appears.



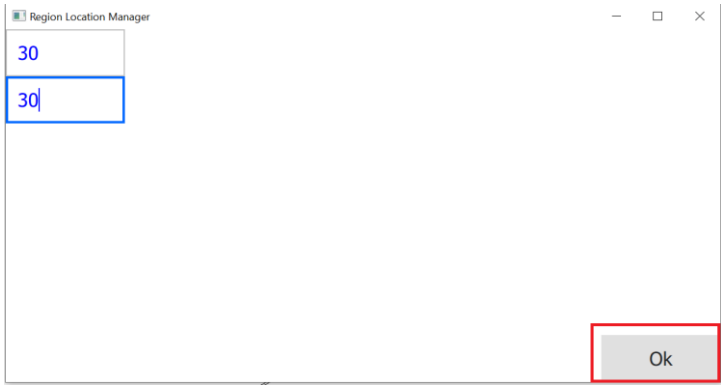
7. Two profiles have been chosen: ‘AA’ and ‘BB’. However, location, chord length, twist angle, and offsets have been added as per the requirement of the 13-meter-long blade in the table. The shape data (X and Y) have been added to the table mentioned on the extreme right side. After adding all the information click on the run option.



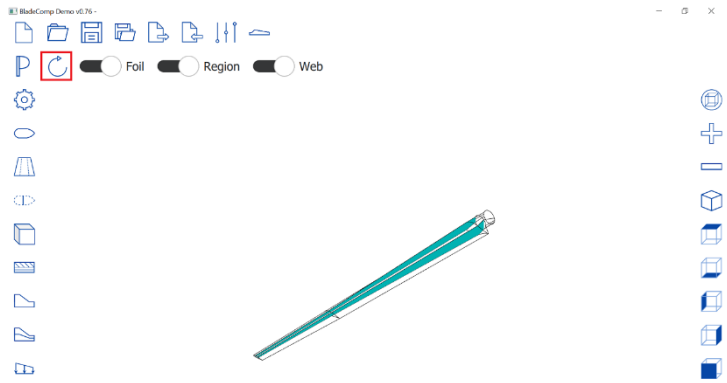
8. Click on the Region location manager option to adjust the chord length.



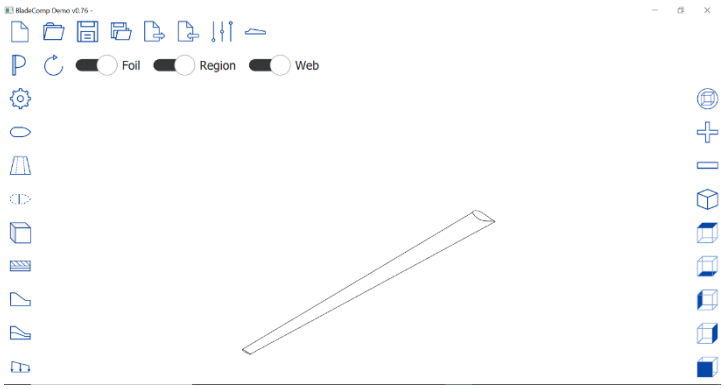
9. As per the data for the geometric shape, the region splits on index 30, so splitting 30, 30 for each region, and click Ok.



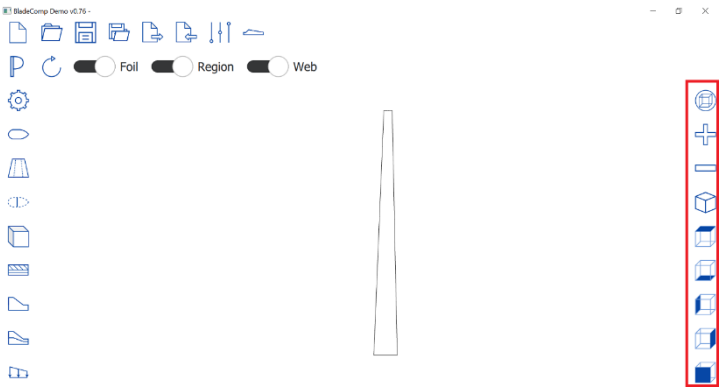
10. Click on the run option to see the changes



11. The shape of the blade with the selection of two regions and two profiles will look like this.

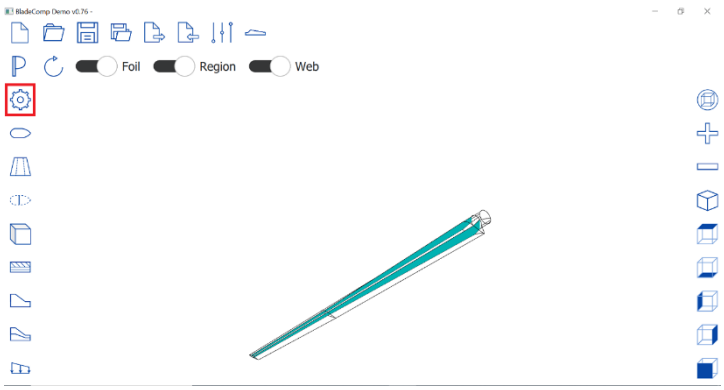


12. To see the blade from other angles, use the highlighted tabs.

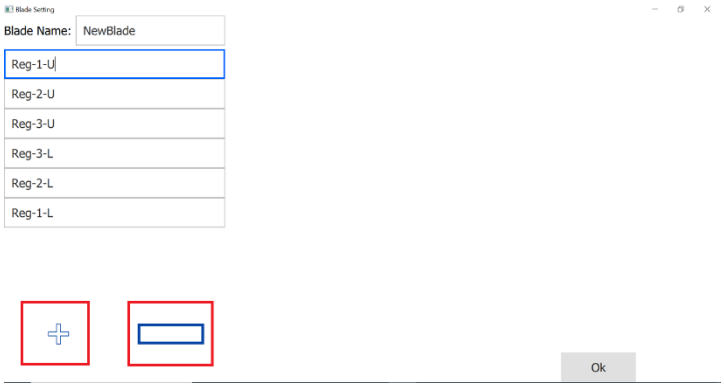


Tutorial 2 – How to add more regions for 13- meter long blade

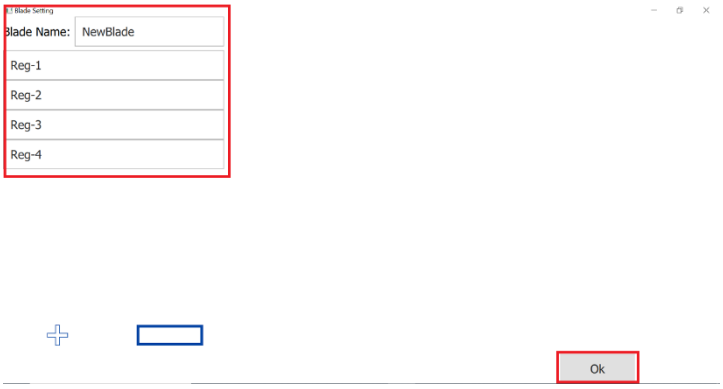
1. To select the number of regions for the blade, go to the setting option



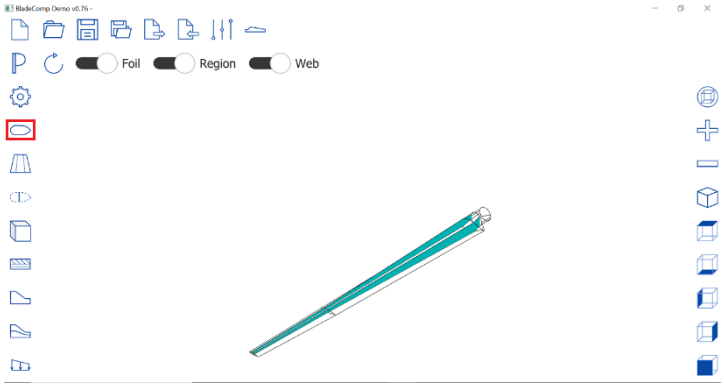
2. Window will look like this, the regions can be added and subtracted using the highlighted signs. The blade name can be edited.



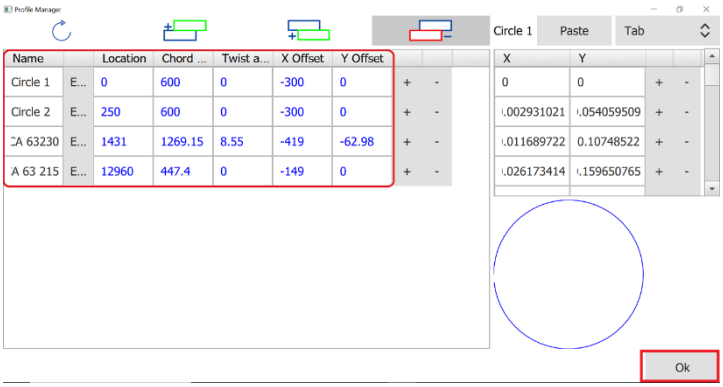
3. The four regions have been selected for this region, with the names ranging from Reg-1 to Reg-4, and click Ok.



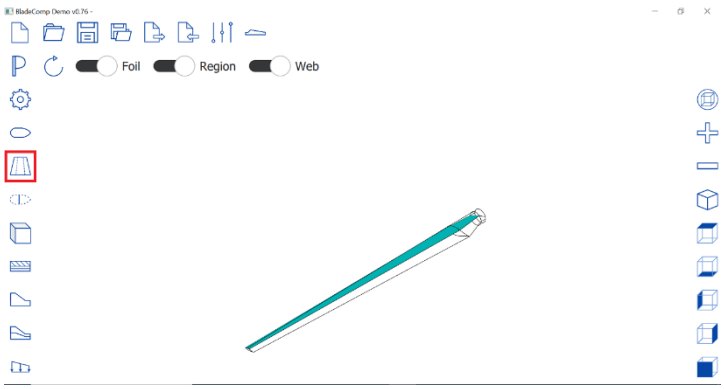
4. To adjust the geometric shape of the blade, such as dimensions, twists, and offsets, click on the ‘profile manager’ tab.



5. Select the four profiles and add the relevant information which fulfils the requirements of the geometric shape of the 13-meter-long blade. Add the required data in the table on the right side of the window (in the form of X and Y) for each profile, and click Ok.

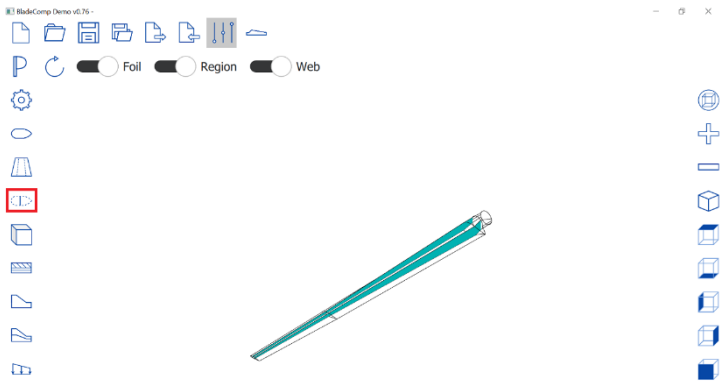


6. Click on the Region location manager to set the chord length.

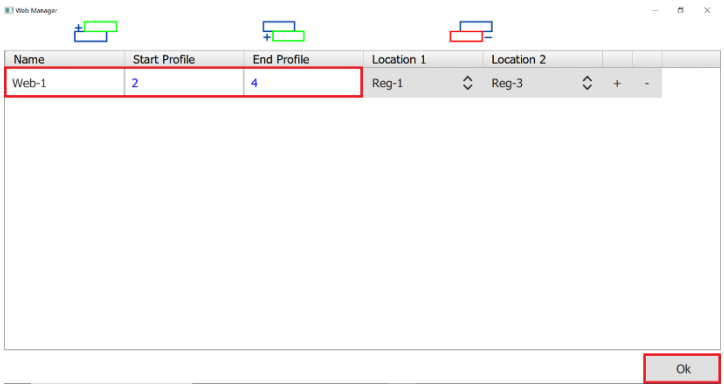


7. Adjust the region location as per the data and click Ok.

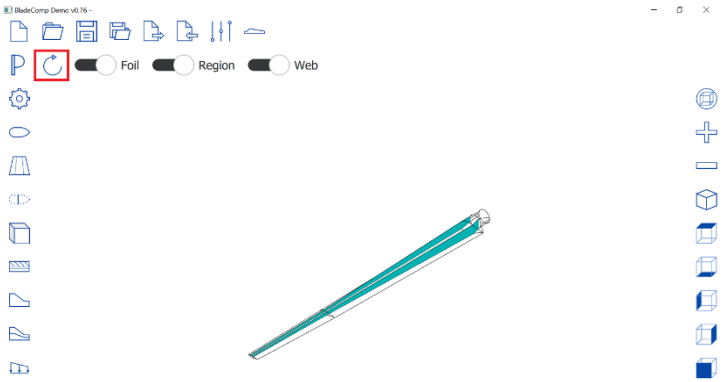
8. Click on the web manager to adjust the location of the web



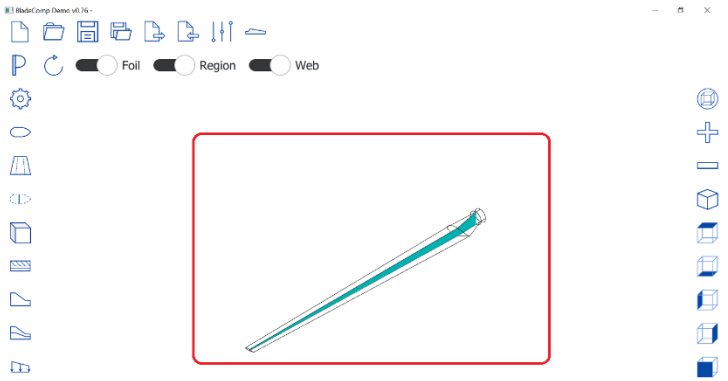
9. Set the start profile and end profile and click Ok. The web can be added and subtracted here using the positive and negative signs.



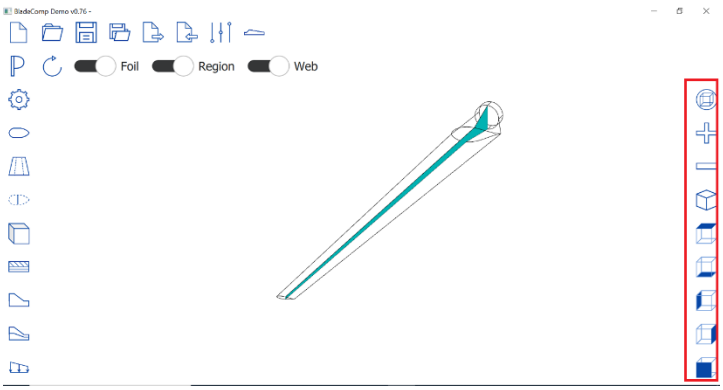
10. Click on the run option to see the changes.



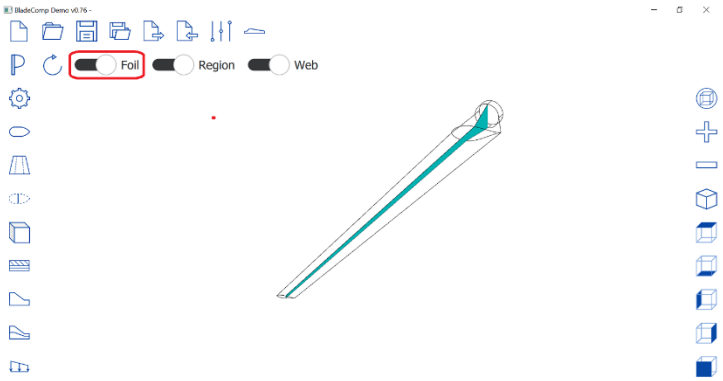
11. The geometric shape of the blade, as per the input data, will be generated. The shaded area of the blade indicates the web of the blade.



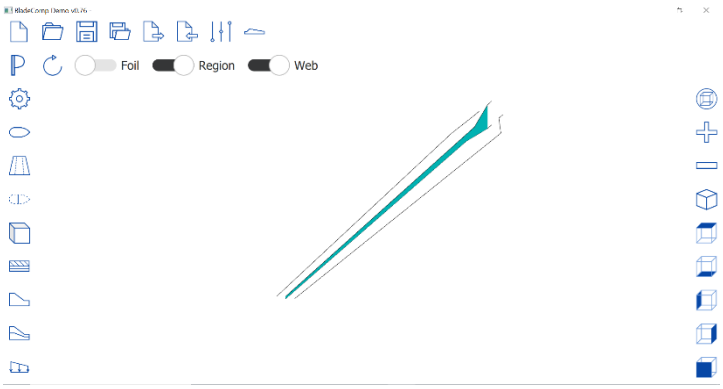
12. The blade can be seen from a different angle using the tabs, or it can be done by pressing the right click of the mouse and keeping rotation.



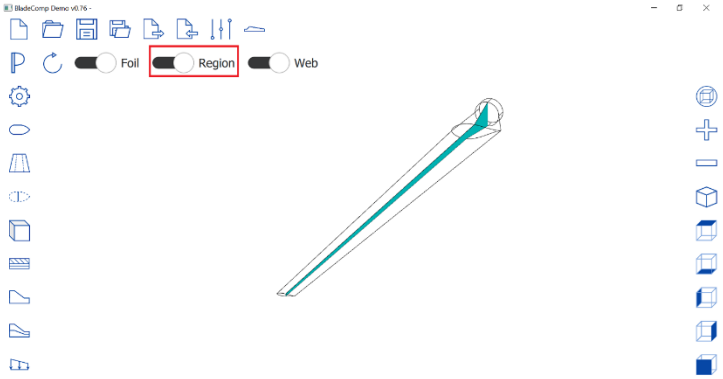
13. Click on the Foil tab to deactivate it and see the changes



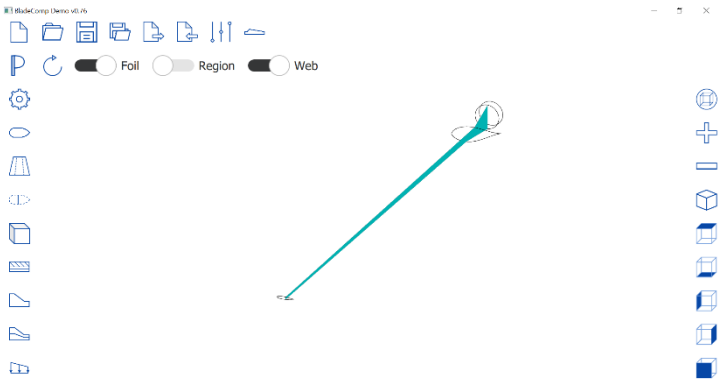
14. The blade will look like this when the Foil option is deactivated



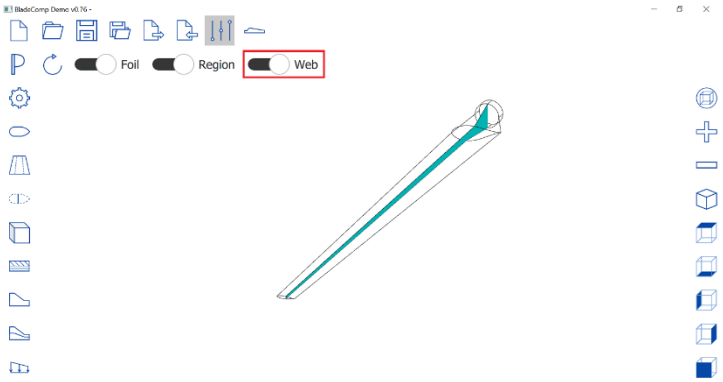
15. Click on the Region tab to deactivate it and see the changes



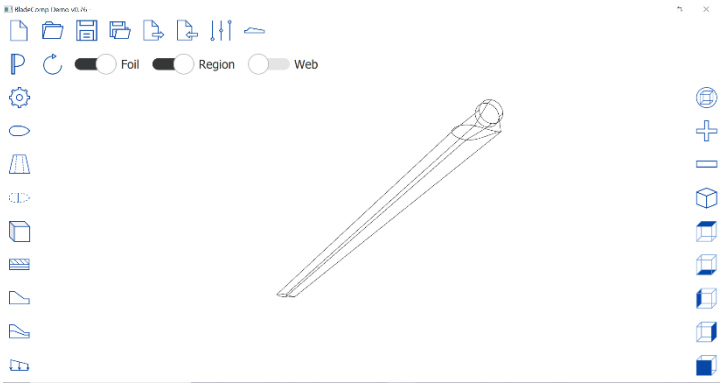
16. The blade will look like this when the Region option is deactivated



17. Click on the Web tab to deactivate it and see the changes

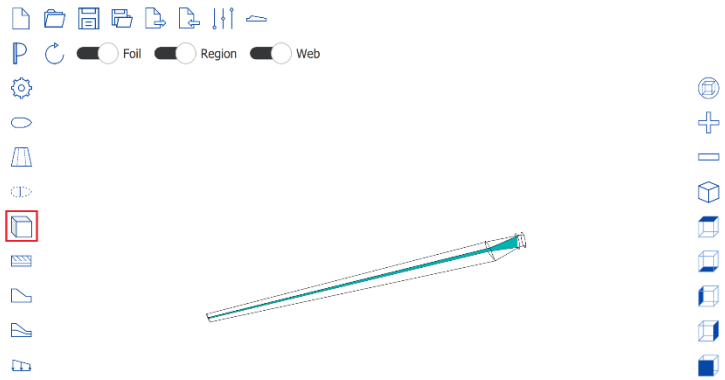


18. The blade will look like this when the Web option is deactivated

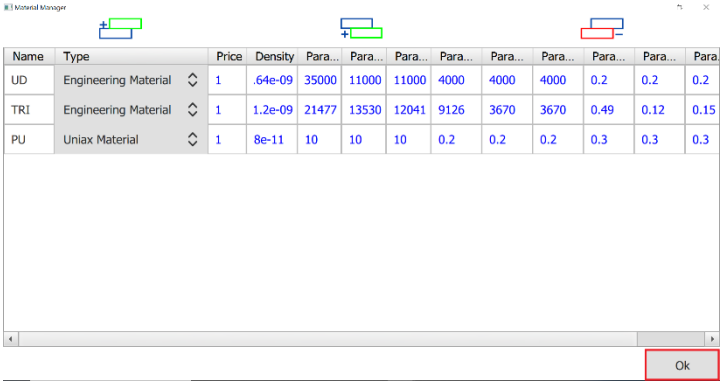


How to define the material for the same blade

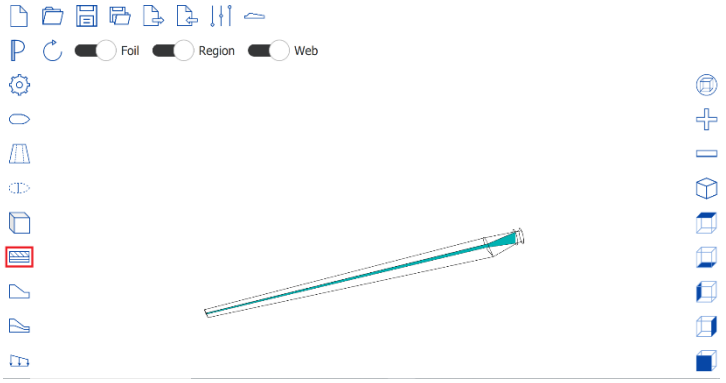
1. To define the material, go to the material manager option



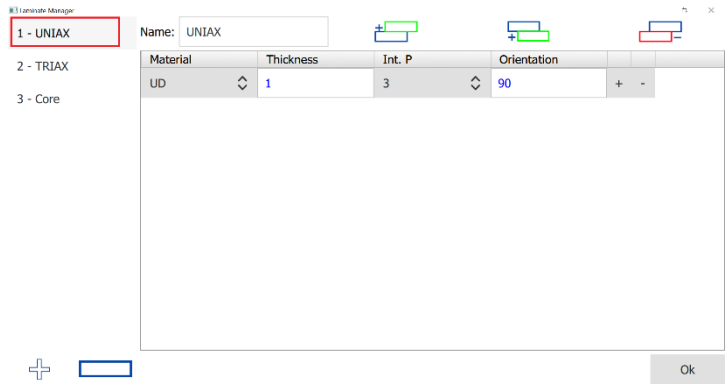
2. The window will appear with the information such as the first column on the left side of the window to select the orientation, the second column to select the type of material, the next column to add the price of material per kilogram, then the next one to define the density for the materials. However, the next nine columns (parameters 1-9) define the young modulus for parameters 1-3, the shear modulus for parameters 4-6, and parameters 7-9 to define the poisons ratio, respectively. Define all the material and click Ok.



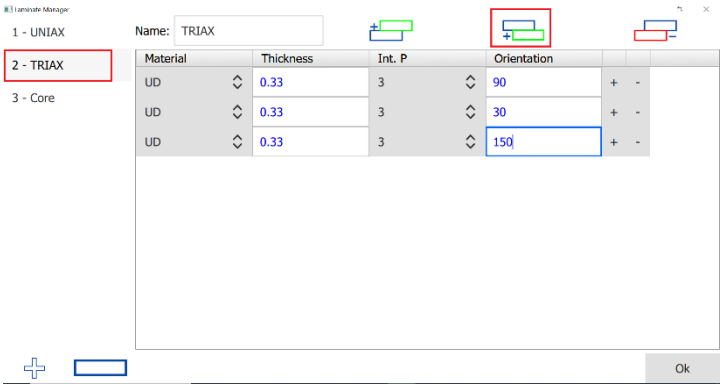
3. For the combination of different layers, click on the laminate manager option



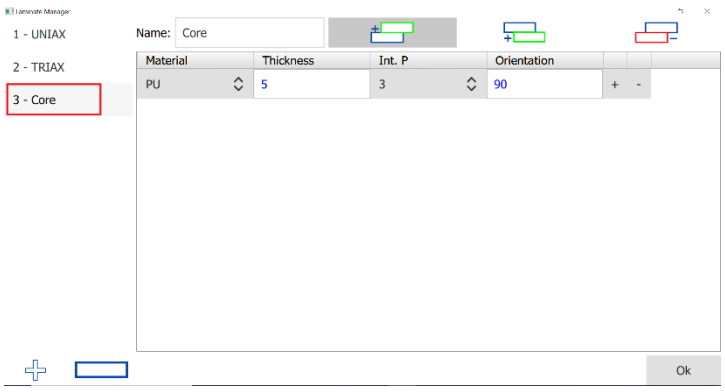
4. Click on the UNIAX option, mark thickness 1 and orientation (degree) 90, and click Ok.



5. Click the TRIAX option for the uniaxial direction and add more layers using the + tab. Add the thickness of 0.33 for each layer and indicate the orientation (angle) for each layer as per the requirement.



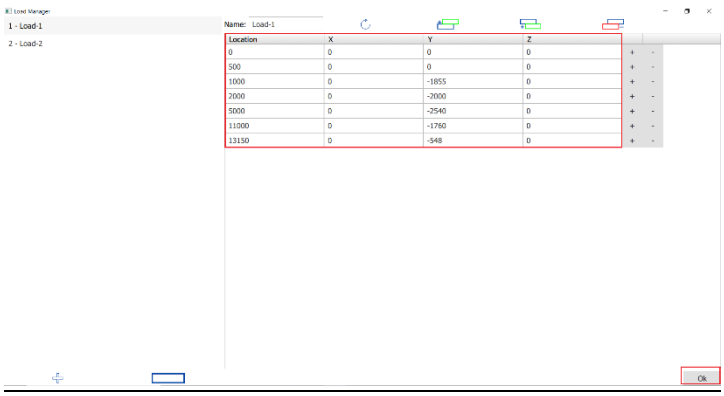
6. Click on the core option for isotropic material and select the number of thicknesses and orientation (angle) and click Ok.



How to define the loading, mesh, and unit price for the blade

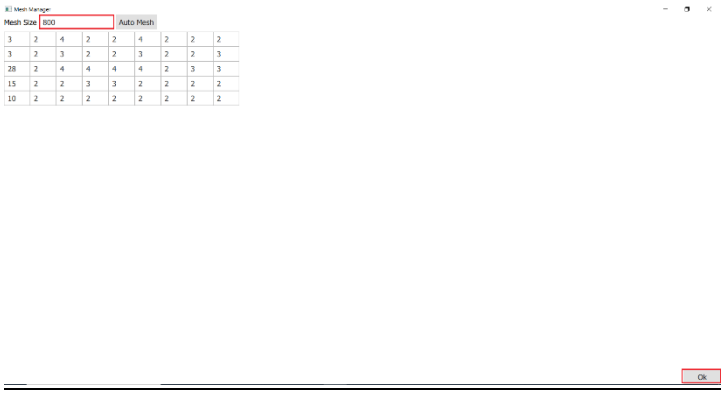
1. To define the loading to the blade go to the load manager option

2. The window will appear with the predefine loading as listed in the tabulated form. However, the loading can be change as per the requirement.

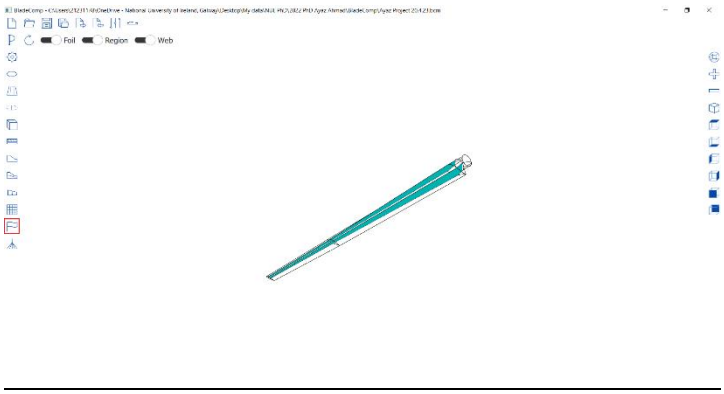


3. To adjust the mesh size for the geometric shape of the blade go to the mesh manager option

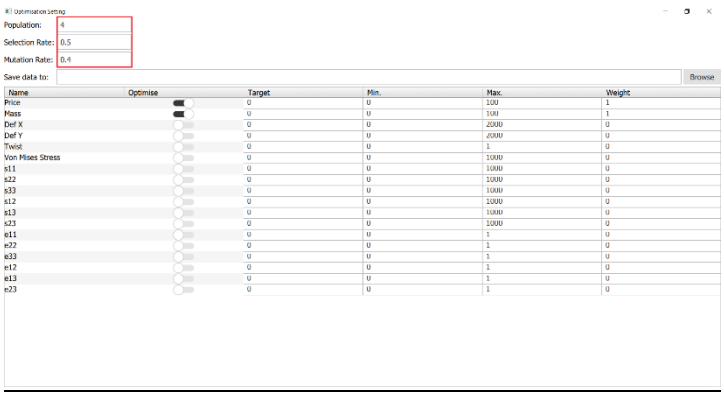
4. Adjust the mesh size and click Ok



5. To add the price, number and mutation rate of the blade, go to the optimization setting option



6. The number of blades selection rate and mutation rate can be adjusted here



How to export the designed blade

1. To export the designed blade or to split the blade into sub blades go to the optimization setting

2. The design for the blade can be exported to the PC, exported as a BladeComp file, or as FE file load case. The number of blades can be generated/exported from the highlighted tab

3. To see the result of the analysis export the file to the required software such as Ansys and ABAQUS go to the analysis setting option

4. The analysis can be save to the required software such as ABAQUS, and click save setting.