# Instructions for XFOIL Analysis of Wind Turbine Geometry

## 1 Prerequisites

1. T-Blade3 executables (tblade3, techop) can be installed following the instructions in the documentation available at `gtsl.ase.uc.edu/t-blade3/T-Blade3_v1.2_ReadMe.pdf`.

2. XFOIL source code and documentation are available at `https://web.mit.edu/drela/Public/web/xfoil`. Only the executable xfoil is needed for this analysis.

## 2 Geometry Generation

Run the following command based on the location of the T-Blade3 executables:
$ /path/to/executables/tblade3 3dbgbinput.1.dat

## 3 XFOIL Analysis

This analysis was carried out with a $(u, v)$ blade section with unit chord such that the LE is at $u = 0$ and the TE is at $u = 1$. Such a file is not printed out by T-Blade3 by default. While the analysis can be carried out with a $(m', \theta)$ blade section (contained in the file blade.1.1.MOGA_TD3), it is recommended that the accompanying file wind_turbine_geometry.dat be used. This file was generated by combining the T-Blade3 output files topcurve.1.1.MOGA_TD3 and botcurve.1.1.MOGA_TD3.

1. Launch XFOIL by running the following command:
   $ xfoil wind_turbine_geometry.dat

2. Enter airfoil name as *wind_turbine_blade*. This opens the top-level xfoil menu.

3. Enter *ppar* at the prompt.

4. This opens the *ppar* menu along with a XWindow instance showing the current panelling of the blade. In the *ppar* menu:

   (a) Set the number of panel nodes by entering *N 351* at the prompt. Hit enter again to escape to the *ppar* menu. The XWindow instance now shows the new panelling of the blade surface.

   (b) Hit enter to escape to the top-level xfoil menu.

5. Enter *oper* at the prompt.

6. This opens the *oper* menu. In the *oper* menu:

   (a) Enter *Visc* at the prompt to move from inviscid to viscous mode.

   (b) Enter Reynolds number as *9.5e5*.

   (c) Next, enter *vpar* at the prompt. This opens the *vpar* menu.

   (d) In the *vpar* menu, enter *N 6.0* to change $N_{\text{crit}}$.

   (e) Hit enter to escape to the *oper* menu.

   (f) Next, enter *Cl 0.95* at the prompt to set $C_l$ and run XFOIL.

7. Once XFOIL converges, the previously opened XWindow instance will show $C_p$ distribution for the boundary conditions set above.

8. Enter *hard* to save the current plot in a postscript file plot.ps.

9. Hit enter to escape to the top-level xfoil menu.

10. Enter *quit* at the prompt to exit XFOIL.