

# Instructions for MISES Analysis of Case LE75

## 1 Prerequisites

1. T-Blade3 executables ([tblade3](#), [techop](#)) can be installed following the instructions in the documentation available at [gts1.ase.uc.edu/t-blade3/T-Blade3\\_v1.2\\_ReadMe.pdf](https://gts1.ase.uc.edu/t-blade3/T-Blade3_v1.2_ReadMe.pdf).
2. MISES is not open-source. Licensing information is available at <https://tlo.mit.edu/technologies/mises-software-design-and-analysis-turbomachinery-blading>. The executables [iset](#), [ises](#), [iprint](#), [iplot](#) are required. The steps outlined were carried out in MISES v2.57.

## 2 Geometry Generation

1. Run the following commands based on the location of the T-Blade3 executables:  

```
$ /path/to/executables/tblade3 3dbgbinput.3.dat  
$ /path/to/executables/techop blade.11.3.Case7-28-5 15
```
2. Rename the file blade.11.3.Case7-28-5 as blade.LE75.
3. In the file blade.LE75 replace the first line *11.3.Case7-28-5* with *LE75*.

## 3 MISES Analysis

This is a summary of the steps required to run MISES for this particular case. Further information about all the executables and files can be found in the documentation at [web.mit.edu/drela/Public/web/mises/mises.pdf](http://web.mit.edu/drela/Public/web/mises/mises.pdf).

1. Place the files blade.LE75 and ises.LE75 in a separate directory.
2. Run [iset](#) first to generate the grid and an initial idat.LE75 file. Run the following command:  

```
$ /path/to/executables/iset LE75
```

This will open a XWindow instance showing the cascade and open a menu in [iset](#). Next, in the [iset](#) menu:

  - (a) Select option *2 Generate spacings and initialize grid*. Hit enter without making any changes to the spacings.
  - (b) Select option *3 Elliptic grid smoother*.
  - (c) Select option *4 Write idat.LE75*.
  - (d) Select option *5 Plot grid*. This plots the generated grid in the previously opened XWindow instance and opens a sub-menu in [iset](#). Hit enter to quit the sub-menu without making any changes.
  - (e) Select option *8 Write grid parameters to gridpar.LE75*.
  - (f) Select option *0* to quit [iset](#).
3. This has created two files: gridpar.LE75 and idat.LE75.
4. Next, launch [ises](#) by running the following command:  

```
$ /path/to/executables/ises LE75
```

The boundary conditions for this case are:

  - (a) Drive inlet slope to the inlet slope value specified in ises.LE75 (*S1*), which can be varied to control the incidence on the blade.
  - (b) Use TE Kutta condition for the current blade.
  - (c) Use LE Kutta condition for the current blade.
  - (d) Drive outlet Mach number to the outlet Mach number specified in ises.LE75 (*M2*).

[ises](#) requires the number of iterations as input. The recommended initial iteration count is 50. For higher positive and negative incidences, more iterations might be required.

5. Once `ises` has converged, run `iprint` to print a summary of the forces on the blade including the loss coefficients  $\bar{\omega}$  and  $\zeta$ . This summary can be saved in a file for future reference on Linux/Unix systems by running the following command:  
`$ /path/to/executables/iprint LE75 > output_filename`

6. Finally, run `iplot` to generate blade surface and contour plots of quantities like Mach number,  $C_p$  or  $C_f$ . Run:  
`$ /path/to/executables/iplot LE75`

This opens a menu in `iplot`. To generate a blade surface Mach number plot:

- (a) Select option *1 Blade surface plots*. This opens a sub-menu.
- (b) In the sub-menu, select option *1 Mach vs x*. This will plot the Mach number distribution in a XWindow instance.
- (c) To save the current plot in a postscript file plot.ps, select option *14 Hardcopy current plot*.
- (d) Select the appropriate option to plot another quantity or select option *0* to quit to the top-level `iplot` menu.

To generate a contour Mach number plot:

- (a) Select option *3 Contour/grid plots* in the top-level `iplot` menu. This opens a sub-menu.
- (b) In the sub-menu, select option *3 Flow contours (MPRQCLT)*. This opens another sub-menu.
- (c) In the contour/grid plot option sub-menu, select option *M* to plot the cascade Mach number contour in a XWindow instance.
- (d) To go back to the contour/grid plot option list, select *-1* or select *0* to go back to the top-level `iplot` menu.

To quit `iplot`, select *0* in the top-level `iplot` menu.