

9. Zero Degree Winds

Zero degree winds are somewhat unique compared to the other modules in Composite Designer. Rather than specify parameters which describe the part and fiber path, the user directly specifies the motion which will generate the part.

As with the other types of wind, the first step in generating a zero degree wind is to click on the New command (File | New or ) , then select Zero Degree Wind from the pop-up menu. This brings up the following parameter entry window:

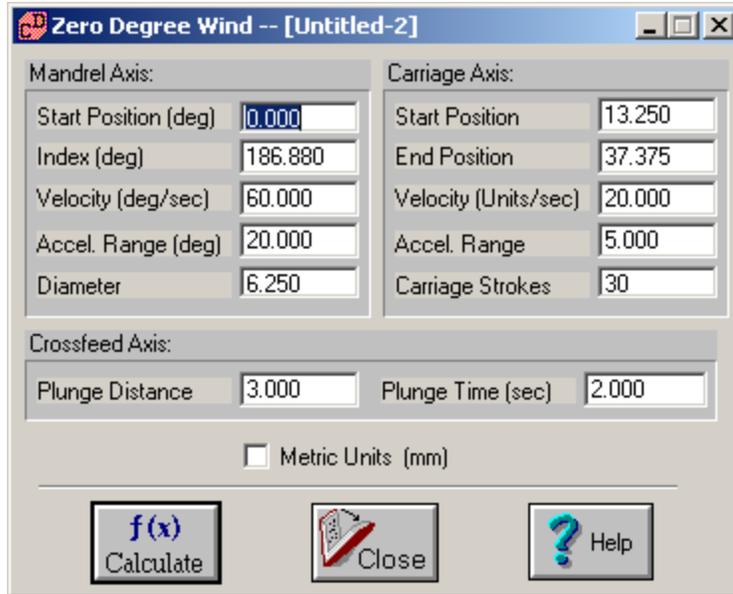


Figure 23 – Zero Degree Wind dialog box

The various portions of this window describe the discrete motion steps required to generate a zero degree wind. The motion consists of the following actions, with corresponding window entries placed in bold:

The cycle begins with the carriage moved to its **Start Position**, the crossfeed plunged in by its **Plunge Distance**, Eye-rotation at either + or – 90degrees (depending on whether or not the carriage’s start position is greater than its end position – if greater, then eye-rotation starts at –90), and the mandrel starts at its **Start Position (deg)**.

The first motion is to retract the crossfeed. It will retract its **Plunge Distance** over the course of its **Plunge Time** (i.e. a complete plunge and retract cycle takes double the plunge time).

Once the crossfeed is withdrawn, the carriage will begin its stroke – achieving its target **Velocity** (in **Units/sec** - either inches or mm) over the course of its **Acceleration Range** – a measure of distance (again inch or mm). It will then coast at target **Velocity** until it is within an **Acceleration Range** of its **End Position**. Finally, it will decelerate over this range and come to rest at its End Position.

Now the crossfeed will plunge in the length of its Plunge Distance over the course of its Plunge Time.

Once the crossfeed has completed this move, the mandrel and eye-rotation will simultaneously begin to rotate – the mandrel will accelerate to its target **Velocity** (in **degrees/sec**), then coast at its target Velocity until it is within an **Acceleration Range** of its **Index** value. Finally, the mandrel will again come to a rest. Over this same time period, the eye rotation will move by 180 degrees to face in the opposite direction.

At this point, the machine has completed half of a circuit and the same motion is repeated (with appropriate axes / positions inverted) to return the machine to its starting location. This entire process is repeated **Carriage Strokes** number of times.

Some issues to consider – the two acceleration ranges must be short enough to complete within the allotted distance (half of **Index** for the mandrel, half the difference between **Start** and **End** position for the carriage). The user may wish to consider the resulting acceleration – (which would be target velocity squared divided by twice the acceleration range). If acceleration levels are too high, the user should reduce the target velocity or increase the acceleration range (for the crossfeed, the plunge time would be increased, eye-rotation acceleration levels are rarely a problem – eye rotation is tied to the mandrel).

As with other types of winds, the actual starting locations for the carriage and crossfeed are influenced by the parameters entered on the motion generation dialog box (see chapter 12). The crossfeed location is the tooling offset and constant eye position entered during motion generation minus the **Plunge Distance** (remember the crossfeed starts off plunged in). The **Diameter** value is not directly used, but the software will warn the user if the crossfeed is plunging in beyond the part's diameter. Of course, this is often the case on a zero-degree wind, so it need not be a major concern. Generally, the user will set the constant eye position value to be greater than the radius of the mandrel, then set the plunge distance such that the payout-eye has sufficient clearance from any mandrel shaft, and set the carriage distance (via start and end points) so that the payout system has adequate side clearance on both ends of the mandrel.

When the user is satisfied with the part parameters, he/she can click on Calculate to continue the process. The zero degree wind is unique in that it does not generate a fiber path, but directly generates motion based on user parameters. Often, this has little affect on the user, but it is a concern when trying to chain multiple layers together (a zero degree wind cannot be chained via path files to layers – for more see section 15.2). It also implies that the user cannot generate a 3D part rendering. Beyond these limitations, the part generation process proceeds normally – after pressing calculate, the software will ask the user if they wish to generate motion. If the user clicks yes, the software will ask for a filename for the wind. It will then generate a *.zro* file and proceed to display the generate motion dialog.

The user would generate motion (see chapter 12), verify / edit motion (generally not an issue for zero degree winds, see chapter 13), and then execute motion (see chapter 17).