

# Approximating a Fillet Radius Onto a Cylindrical Hub in PropCad

## A HydroComp Technical Report Report 125

### OVERVIEW

PropCad does not have the ability to develop true fillet intersections between blades and hubs. The reasons for this are:

1. Surveyed propeller builders indicate that it is difficult to NC-mill in this region (e.g., the areas are too tight), making accurate definition of the fillet somewhat questionable. Most builders still rely on fillet gages and hand finishing to achieve the intended shape.
2. The proper geometric definition of a fillet between a blade and a hub (i.e., the intersection of three complex surfaces) is a very difficult geometric problem to solve.
3. Most CAM software already has this capability. Therefore, we feel that adding this complex capability to PropCad is not cost-effective for users of the program.

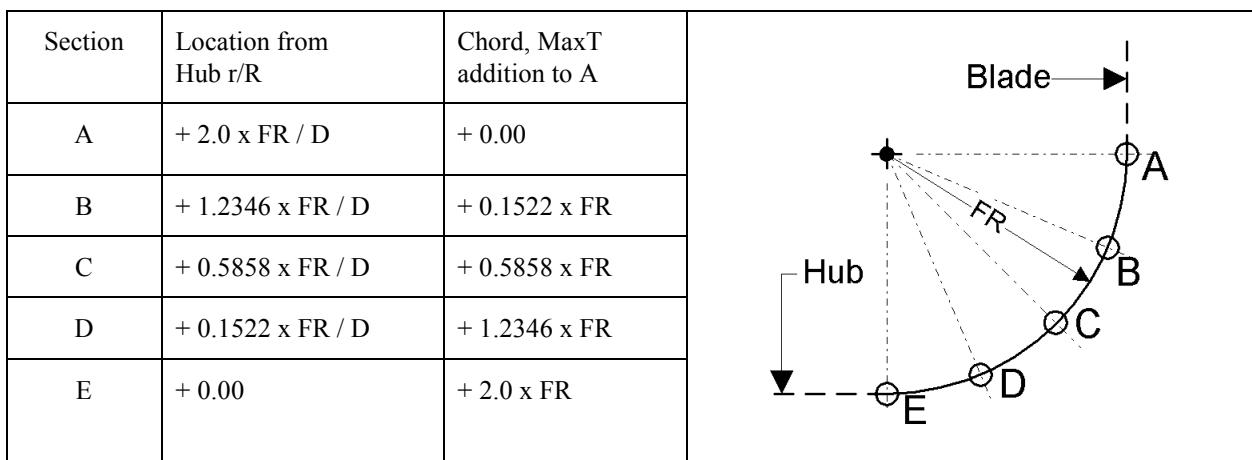
### AN APPROXIMATION

There is a way to approximate a radius fillet, however, if the hub is a cylinder. The technique is to add sections between the hub and blade that model a fillet. We call this an approximation because the fillet geometry is developed in the 2D expanded system, and in 3D the radius will be altered due to the wrapping of the section along the helix.

### TECHNIQUE

The procedures to develop these sections are as follows.

1. Determine the location of 5 new sections that will be used to model the fillet radius (FR). These will be based on dividing the fillet radius into four equal sections, as shown in the accompanying graphic.
2. In the *Section definition* table, *Insert* a section A at the bottom of the table, whose section



location (i.e.,  $r/R$ ) is the hub location plus  $2 \times FR / \text{Diameter (D)}$ .

3. *Copy* and *Paste* the closest defined blade section into the new section A row.
4. Use the *Fit* feature to automatically determine faired values for chord length, thickness, skew, etc. for section A.
5. *Insert* section B at the bottom, at a location equal to the hub location plus  $1.2346 \times FR / D$ .
6. *Copy* and *Paste* the data from section A into the new section B row.
7. *Fit* the section B data. Then edit the *Chord* and *MaxT* fields by adding  $0.1522 \times FR$  to the section A *Chord* and *MaxT* values.
8. Repeat steps 5-7 for the remaining sections using the figures from the table below.

**NOTE:** You may also have to alter the *Rake* figures in the *Section definition* table. If your sections have the pitch plane on the propeller face (i.e., pressure side) - as many do - you will have to shift these sections toward the face so that the distribution of the fillet radius is evenly distributed to both the back and face.

HydroComp, Inc.  
13 Jenkins Court, Suite 200  
Durham, NH 03824 USA  
Tel (603)868-3344  
Fax (603)868-3366  
info@hydrocompinc.com  
www.hydrocompinc.com