Darrieus wind turbine uses the old NACA symmetrical airfoil. The problems are NACA symmetry airfoil data at low Reynolds number and large range of angle of attack are scarce and seems inconsistent. Below are some comments on Strickland, Sheldahl, Jacobs, and Jesch low Reynolds data. If you need low Reynolds number airfoil data i.e. lower than 360e3, then why not try digitised Jacobs's data for small angle of attack and then attach Sheldahl data to the remaining angle of attack. Complete airfoil data of 360° is not really important. Theoretically for tsr > 1, only data from 0 to not more than 90° is needed.
> Comparing Naca airfoil data

If the aspect ratio of the airfoil blade is low, modification need to be done to account for the finite aspect ratio. At angle of attack before stall, airfoil behaviour can be predicted accurately using Lanchester-Prandtl model. For angle of attack greater than stall, the airfoil behaviour is not clear. Anyway, the published Viterna Corrigan model extends the Prandtl model by adding some equations after stall angle to predict the lift and drag in these regions.
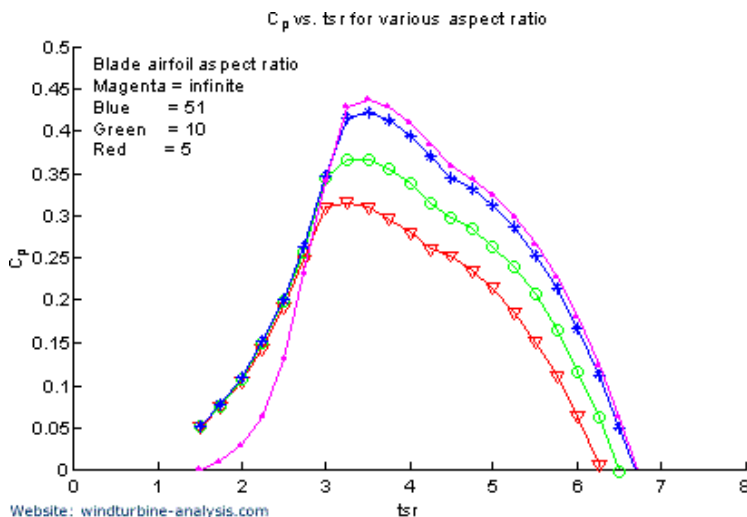> Finite aspect ratio airfoil data modification [Matlab code]

Multiple streamtube model code in Matlab

Below are the streamtube model codes for simple STRAIGHT BLADED Darrieus rotor only and with the digitised Strickland Naca0012 airfoil data. A simple crude modification for the streamtube model when momentum equation fails was done using the Glauert empirical formula. This problem never seems to be addressed in research paper, any idea? The code accepts and uses variable Reynolds number data (but u can just throw in one single Re data like the sample run). No dynamic stall or pitch changing feature included. These codes were running fine under Matlab version 5.3.
> Strickland NACA0012 airfoil data at Re=300e3
> Viterna-Corrigan model code "makefinitedata.m", sample run, & plotted output graph
> Airfoil data interpolation code "builddatatable.m", sample run, & plotted output graph
> Multiple streamtubes code "predictcpcurve_sm.m", sample run, & plotted output graph
> Additional scripts "batchsol.m" and "batchtablesplot.m" for batch processing

Power coefficient curve result from streamtube model

The first graphs (on the top of the page) shows result from the streamtube model with various solidity. Increasing solidity decreases tsr range, increases torque coefficients, sharper curve instead of the desired flat curve, and insignificant maximum Cp changes. Testing result also shows similar trend.

The graphs right above here shows expected result of Cp with decreasing aspect ratio if Viterna Corrigan model used to modified the airfoil data. Infinite airfoil data is not as smooth as the modified Viterna data so output curve is not as smooth also. The higher Cp values at low tsr range in infinite span airfoil blade is due to the Viterna Corrigan model predicting very high lift after stall and lower overall drag.

Dimensional analysis of Darrieus rotor performance

It seems that no dimensional analysis was mentioned at all for Darrieus rotor performance. Directly from the streamtube model momentum equation we found that Cp is a function of tsr