



Vista™ - Visual Turbomachinery Analysis

Key features

- Optional boundary conditions - specified mass flow, pressure ratio, or exit swirl angle.
- Highly curved annulus walls and calculating stations within blade-rows are both permitted, so that arbitrary and complex meridional geometries may be analysed.
- Compressible or incompressible fluids.
- In compressible flow machines supersonic relative flow in blade rows is included. Blade-row choking incurs additional loss, and affects distribution of the meridional flow.
- Ideal gas or real gas
- Vanes can have swept and curved leading- and trailing- edges.
- Solution includes an approximation to the blade-to-blade flow field, including the effects of splitter vanes.
- Spanwise mixing across the meridional streamtubes is computed by a new model which accounts for turbulent diffusion and deterministic secondary flows.
- Powerful post-processing
- Vista TF can operate as a standalone tool but it is also integrated in ANSYS® BladeModeler™ within Workbench 12.

Vista™ TF - a general turbomachinery throughflow code

Overview

Vista TF is a streamline curvature throughflow program for the analysis of any type of turbomachine. Vista TF has been developed in the first instance primarily as a tool for radial turbomachinery but it is applicable to virtually any type of turbomachine. Although Vista TF is a relatively new code, it is based on an established throughflow pedigree going back more than twenty-five years. It has become the standard radial turbomachinery throughflow tool for PCA Engineers and for several of its clients. Vista TF is integrated in ANSYS® BladeModeler™ within Workbench 12.

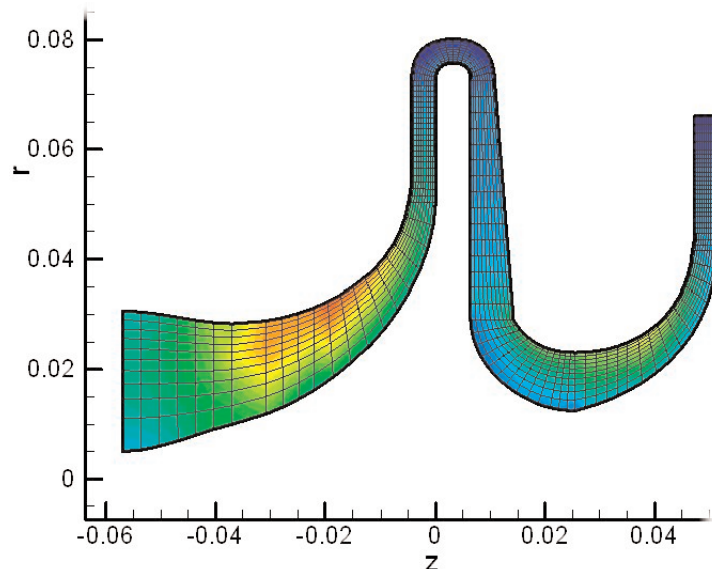


Fig. 1 Vista TF solution for a two-stage centrifugal compressor

A rapid screening tool

The code is perfectly suited for the early part of the detailed aerodynamic design process and is the ideal precursor to full CFD analysis. The overall aim of the turbomachine designer is to obtain a design that combines excellent aerodynamic performance, good matching to the required duty, low stress levels, low noise, and with no resonant frequencies in the operating range. It must also be economic to manufacture. This aim is achieved by an iterative process of analysis, judicious tuning of the impeller geometry, and subsequent re-analysis. Vista TF contributes invaluable to this process by enabling the designer to carry out a rapid, effective screening process ahead of full CFD analysis. The result is a far quicker overall design process, and consequently the engineer can devote more of his own time to the resolution of real design issues, rather than expend it in the detailed analysis of what may eventually prove to be unsuitable designs.



Vista™ TF and ANSYS® BladeModeler™

Vista TF is integrated in ANSYS® BladeModeler™ within Workbench 12. In this combination the power of Vista TF as a screening tool is even more evident; having eliminated unsuitable designs before initiating full CFD analysis, Vista TF can then pass to BladeModeler™ its most successful design, thus getting the full CFD analysis off to a flying start.

Centrifugal compressor and radial turbine design optimisation

Vista TF has been successfully integrated into a centrifugal compressor impeller design optimisation system employing a genetic breeder algorithm.

Accurate geometry

The turbomachine's geometry can be accurately specified, so ensuring as precise a throughflow solution as possible. Highly-curved annulus walls and calculating stations within blade-rows are both permitted, so that arbitrary and complex meridional geometries may be analysed. Vanes can have swept and curved leading- and trailing- edges.

Powerful enhancements

The solution includes an approximation to the blade-to-blade flow field, including the effects of splitter vanes. The code can optionally apply spanwise mixing across the meridional streamtubes using a new model which accounts for turbulent diffusion and deterministic secondary flows.

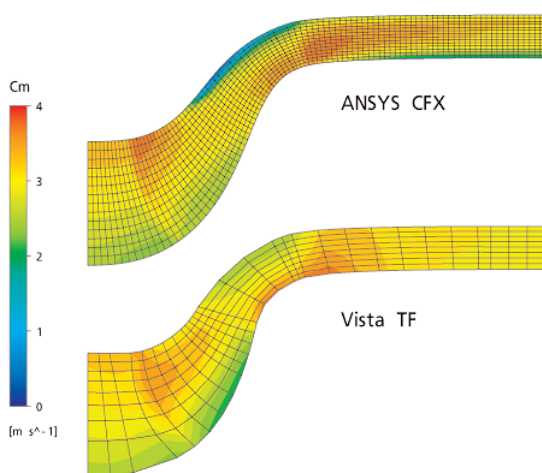


Fig. 2 Solutions for a mixed-flow pump

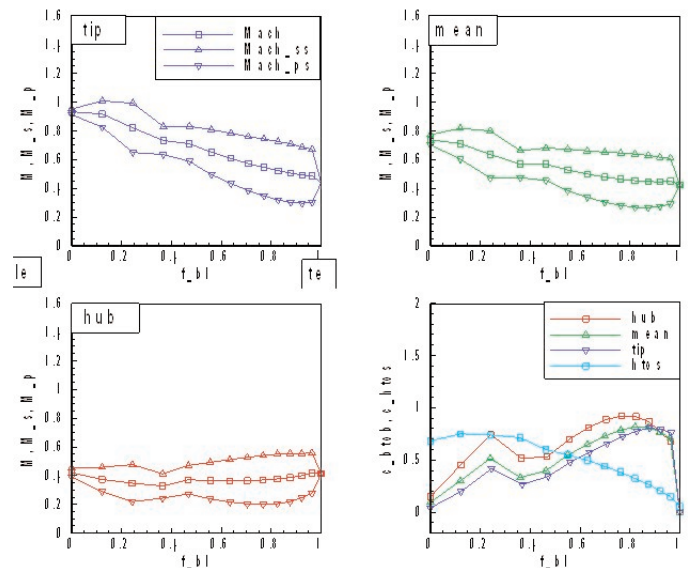


Fig. 3 Vista TF solution for a centrifugal compressor

New developments

Currently under development for the next release of Vista TF are:

- an optimisation system for radial turbine wheels
- a real gas model for application to refrigerant compressors, steam compressors, and other real gas machines.

Published material

Vista TF has been extensively reported as follows:

Casey, M.V., Robinson, C.J., "A new streamline curvature throughflow code for radial turbomachinery", ASME Turbo Expo 2008, Berlin, ASME GT2008-50187

Casey, M.V., Gersbach, F., Robinson, C.J., "A new optimisation technique for radial compressor impellers", ASME Turbo Expo 2008, Berlin, ASME GT2008-50561

Cox, G., Roberts, A. and Casey, M.V., "The development of a deviation model for radial and mixed-flow turbines in throughflow calculations" ASME GT2009-59921, submitted to ASME Turbo Expo 2009, June 8-12, 2009, Orlando, Florida, USA.

These papers can be downloaded from the PCA website www.pcaeng.co.uk.