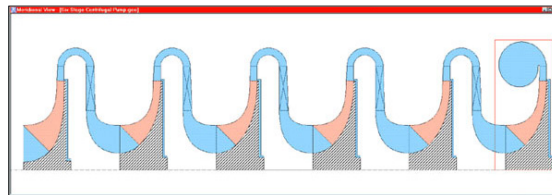


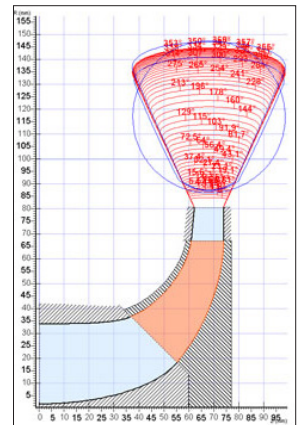


## PUMPAL®

A MEANLINE APPROACH IS USED TO DESIGN CENTRIFUGAL AND MIXED-FLOW pumps with single and multiple stages. Concepts NREC's PUMPAL® CAE software program can be used to design the stage, analyze performance, refine the parameters with data reduction, and model the machine according to several performance models. PUMPAL's unique Design Wizard leads the user through all the necessary steps for design, analysis, and data reduction. The meanline pump design can easily be sent to AxCent® for further blade design and fluid dynamic analysis.

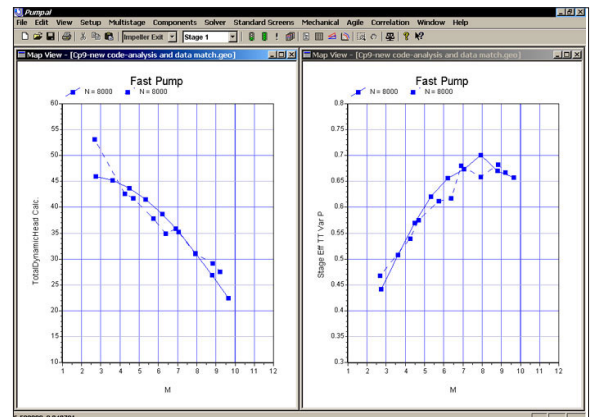


Single-stage and multistage pump design examples.



## Components Supported by PUMPAL

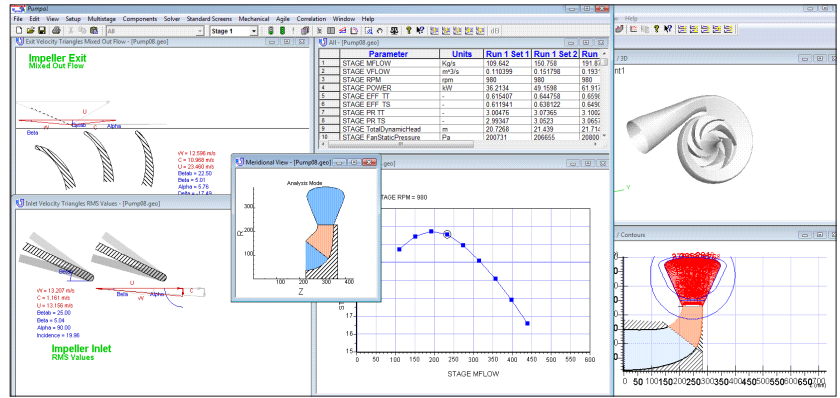
- Inlet guide vanes
- Open or closed impellers
- 2D or 3D impellers
- Front and rear seals
- Various leakage paths
- Multistage pumps
- Diffusers, including: Arbitrary Vaned; Vaneless; Wedge/Channel; Cascade; Conical; 90/180-degree Bends
- Exit elements, including: Collector; Volute; Return Channel



Performance map overlay with data reduction.

# Modeling

PUMPAL supports Two-Elements-in-Series (TEIS) rotor diffusion modeling, two-zone loss modeling, radial and axial stator diffusion/losses, volutes, inlet cavitation, disk friction, exit mixing, cavity leakage, and more. PUMPAL uses the same model of stage performance for design, analysis, and data reduction modes.



# Easy Editing

View the pump stage in an active, true-scale meridional view. Edit parameters by double clicking on the component or using a single text input/output file, which is especially useful for optimization.

Seamless integration with AxCent.

# Integrated Performance Map Plotting

Review design performance, analysis, and test data with flexibly-plotted performance maps, updated automatically with each geometric change.

# Preliminary Mechanical Analysis

PUMPAL provides the user with an initial calculation of mechanical properties of the design. Stress, vibration, and fatigue limit estimates are given and access a wide database of customizable material properties.

# Axial View with Inlet, Exit Velocity Triangles

Using the window view, you can view blades and velocity triangles at the impeller inlet and exit. View inlet velocity triangles for the hub, tip, or RMS radius, and exit velocity triangles for the primary and secondary zones, and mixed-out state.

# A Real Fluid Program

PUMPAL calculates real fluid properties using optional D.B. Robinson Real Fluid Properties, NIST, or ASME steam routines.

# Direct Integration with AxCent®

Users can start AxCent automatically from PUMPAL, with the initial meanline geometry transferred automatically. Changes in AxCent that affect the meanline analysis will cause the meanline analysis to be rerun and all performance maps to be regenerated.

Agile Engineering Design System® Applications

		Radial Pumps	Fans & blowers	Turbines	Axial Compressors	Pumps	Fans & blowers	Turbines
Preliminary design	COMPAL®	✓						
	PUMPAL®		✓					✓
	RITAL™				✓			
	FANPAL™			✓				✓
Detailed design	AXIAL™						✓	✓
	AxCent®	✓	✓	✓	✓	✓	✓	✓
CFD	Pushbutton CFD®	✓	✓	✓	✓	✓	✓	✓
FEA	Pushbutton FEA™	✓	✓	✓	✓	✓	✓	✓
Optimization	TurboOPT II™	✓	✓	✓	✓	✓	✓	✓
CAM	MAX-PAC™	✓	✓	✓	✓	✓	✓	✓

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# CONCEPTS NREC

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Concepts NREC design software is compatible with all commercial design packages.