

# Design Optimization of a Low Pressure Steam Turbine Stage

**Challenge:** Improve the performance of a low pressure (LP) steam turbine stage preserving original rotor count and hub design.

**Results:** Two percent gain in turbine performance.

**Impact:** Increased efficiency delivers more power for same steam rate.

The low pressure end of a multi-stage steam turbine presents many technical challenges. Developing high efficiency blading that is acceptable both aerodynamically and mechanically requires integrated analysis in the design environment.

A turbine end-user wanted to optimize the performance of one of his turbines (Figure 1), and submitted the last stage of his steam turbine for analysis and optimization. The stage was analyzed using CFX software which employed real gas properties in order to correctly model the thermodynamic properties of steam. A compound-leaned stator design was developed to replace the original stator. This new design reduced transonic losses and provided improved loading from hub to shroud. Using ANSYS FEA software and CFX CFD

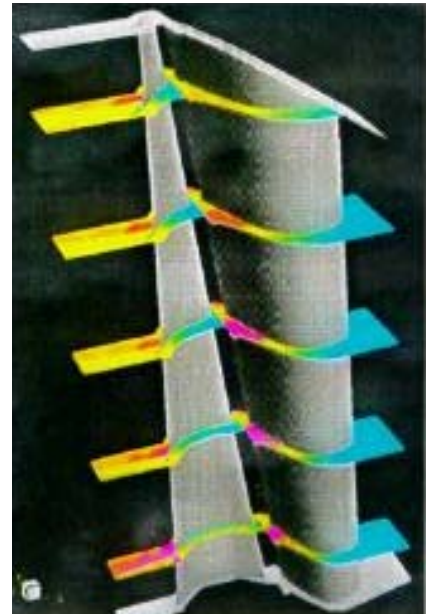


Figure 1: Original Design.

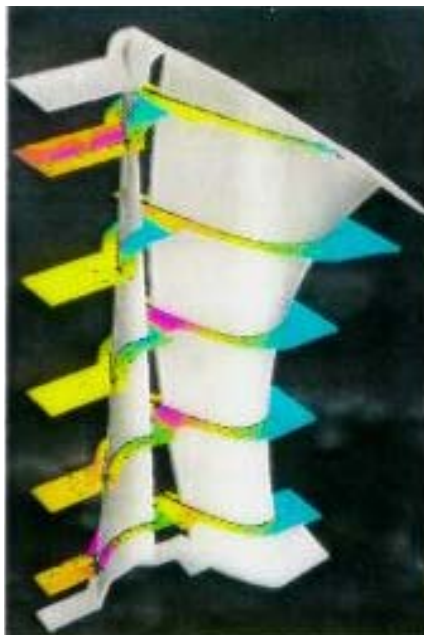


Figure 2: Redesign.

software a new rotor was also designed and optimized aerodynamically and mechanically.

The result of the analysis and optimization was a stage with substantially increased performance compared with the original design. Detailed experimental analysis of the machine in the field confirmed these results. Furthermore, the redesigned turbine provided an additional two points of efficiency to the user (Figure 2).

