Estimating Tool for Single-Piece Impeller Milling

Overview
Dresser-Rand uses a Microsoft Excel-based program to determine if a compressor impeller design can be milled from a single piece of material, as well as, estimate the milling cycle time and cost. However, this program has very limited capabilities and does not incorporate the newer tools that Dresser-Rand uses. This project aims at improving the functionality of the current estimating tool so that it can provide a more accurate determination of single-piece milling and estimates for the cycle time and cost.

Objectives
The project has four main objectives. New tools need to be added to the program. Tool reach needs to be considered in the milling process. The complex milling paths need to be more accurately determined. The cycle time and cost estimating features need to be updated.

Approach
- The current program’s tool and machine databases were removed
- Two undercutting end mill tools were added to the program and the maximum tool diameter was increased to 1.25"
- A function was made to generate the minimum and maximum roughing tool diameters
- The maximum tool reach for the impeller channel was calculated
- Blind spots at the corners of the channel were checked using newly defined points
- Cycle time was determined using volume removal rates from all calculated tools
- Tooling cost was added to the estimation of the cost to mill
- The finalized code was debugged and checked for any remaining errors
- A comprehensive instructional page was created to teach the user how to operate the program
- The program was tested using the CAD models of 11 sample impeller designs
- The results were compared to Dresser-Rand’s actual milling processes

Outcomes
The project had the following outcomes:
- 6 of the 11 sample impellers could not be single-piece milled, agreeing with the results from Dresser-Rand
- The program will report to the user whether the given impeller design can be single-piece milled
- If single-piece milling is possible, the program will output information on the required tool dimensions, the estimated milling cycle time, and all costs associated with the process