Estimating Tool for Single-Piece Impeller Milling

Overview
Dresser-Rand has recently begun single-piece milling its impellers, a vital component of centrifugal compressors. Currently, there is no system in place to estimate the cycle time or cost of milling these impellers. Dresser-Rand produces several different styles and sizes of impeller, all of which vary in terms of the time it takes to mill.

Objectives
Dresser-Rand has assigned our team to develop an Estimating Tool that will:
- Characterize various styles and sizes of impellers
- Recommend specific tools, tool holders, and machines depending on impeller design
- Determine cycle time and approximate cost to single-piece mill an impeller

Approach
- Analyzed impeller CAD drawings for key factors in terms of the milling process
- Researched Dresser-Rand’s milling machines, tooling and tool holders:
  - To map single-piece milling capabilities
  - To add all information in the Estimating Tool database
- Drafted Visual Basic (VBA) program to produce the desired outputs
  - Program utilizes several sub-procedures and calls to identify the following:
    1. The program determines if single-piece milling is feasible for a particular design.
    2. The program selects appropriate tools for roughing and finishing based on impeller design.
    3. Cycle time is determined by calculating the material removal rate (MRR) using derived equations for feed rate and spindle speed.
    4. Cost is determined using cycle time and the overhead cost.

Outcomes
By using the Estimating Tool, Dresser-Rand will be able to predict a cycle time and approximate cost to single-piece mill an impeller. The estimating tool predicts a best case cycle time, and since single-piece milling is a new technique for Dresser-Rand, the company will now have a target at which to aim in terms of reducing its cycle times. The tool will also allow Dresser-Rand to accurately quote the cost of milling an impeller its customers, thus making its budgeting and resource allocation much more efficient.