Project Plan

IPRO 330 – Operator Information Tool to Manage Heat Treat Furnace Parts for A.Finkl & Sons
Illinois Institute of Technology, Spring 2006

Project Objectives:

- To generate an accurate survey of temperature distribution within the furnace.
- To determine a method of stacking that provides the most uniform temperature distribution.
- To create an efficient and intuitive tracking system that allows the exact location of each part in the furnace to be recorded and catalogued for future reference.
- To put this knowledge together to create a software package that can be used to quickly and easily generate a stacking sequence that will result in a proper heat treatment for each piece in the furnace each time.
- To fulfill all IPRO requirements

Project Background:

The engineers at Finkl operating the heat treatment facility need to optimize the furnace load configurations in order to maximize the number of pieces which may be heat treated without the necessity of an additional heat treatment due to inadequate tempering.

The engineers would like to have a simple way to visualize and manipulate the loading configuration of pieces of steel inside a virtual furnace. The heat treat Foreman could then key in a furnace load number at his computer or handheld device and see a block diagram of the optimized configuration to load the furnace. The load configuration file provides electronic recordkeeping that is helpful in recalling past heat treat jobs and reviewing how the pieces were arranged inside the furnace.

This project will consist of two parts. The first part is to create a software package to represent the 3-D world inside a furnace in 2-D in order to plan the stacking of parts in a fixed space so that the heat distribution is more or less uniform over each piece in the load. This representation has to be presented to the operator visually so that he can select and manipulate graphical representations of the part shapes available from a menu of shapes. Since the operator needs this ability during the stacking operation, the program should be run on a PDA or a local PC. Possible 3-D solutions could involve defining a surface or solid model in a file, which can be generated by a CAD package (Pro/Engineer, Unigraphics, SolidEdge, etc.). This file permits verification and review of heat treatment conditions and troubleshooting and will also be used in the next step of the process to simulate the heat treatment.

In order to simulate the heat treatment process it is necessary to have real data on the time-temperature profile of parts in different configurations. These data will be obtained by thermo-coupling test blocks and running them through real heat treatments with other parts. The data will be analyzed to obtain heat transfer coefficients related to position in the furnace and load configuration.

Methodology:

The team will work closely with Finkl employees on this project throughout the semester and several trips to the Finkl plant in Chicago are planned. The team has identified the specific tasks at hand as follows:

- 3D CAD drawings of the furnaces, the loading zone, and the actual parts being treated must be generated.
- Furnace surveys must be conducted and used in conjunction with the drawings to determine ideal loading conditions.
- A basic software program must be written that can take these drawings and use them to catalogue the stacking sequence in the furnace for a given treatment cycle.
- Ultimately, this software must be adapted to allow a stacking sequence to be determined prior to loading that guarantees a proper heat treat for each item in the furnace.

The first three tasks are being tackled simultaneously, while the final item consists of a synthesis of these three tasks. All the data and information required to accomplish this is either in the team's possession now or can be found within Finkl's database. Therefore, we are confident that we will be able to accomplish all these tasks successfully and in full.