**Quantification of Cast Aluminum Pores using MATLAB (by Rayens, N., Cai, P., and Zhai, T.**)

This project focused on the development of MATLAB code which was designed to process images of aluminum castings for micro-pores that occurred during solidification. Initially, the code was created to identify the pores in the images by selecting areas that were darker than their surroundings; pore identification was signified in MATLAB with a ring around the fault. This program was then refined so that the code was able to identify faults while ignoring dark bands at the edges of the images. Additional refinements allowed for the grouping of faults that were located within a certain distance of each other. Clusters of pores were then identified with rings of the same color around their constituent pores so that each cluster could be differentiated from the others. Finally, the code was further refined to prevent large, clearly-individual pores from being added to clusters, and to limit the chaining of pores to a specified radius from the central-most pore so they couldn’t aggregate into one large cluster across the whole image. Ultimately, the code was able to characterize pore clusters in terms of their sizes, numbers of pores and average distances, in order to identify those clusters at which fatigue cracks were nucleated in the cast aluminum alloys, as a critical step towards accurate life prediction of the alloy in engineering applications. While micro-pore clusters have been recognized as the preferred fatigue crack nucleation sites, the quantitative relationship between these pore clusters and crack nucleation had not been established previously.