In this research, the author proposed a method to improve machining efficiency for the magnetic abrasive finishing (MAF) for internal surface finishing of pipe by applying the electrolysis process. In order to confirm the method feasibility, an experimental setup and a new tool was developed. Furthermore, the research studied the finishing mechanism, finishing characteristics and revealed its usability in the industry.

In chapter 1, the research introduction, background, and its important were explained. The previous research regarding the methodology of internal surface finishing of pipe utilizing the magnetic abrasive technology was reviewed. Eventually, the current research’s needs and scope were elaborated and defined.

In chapter 2, to improve the surface finishing quality and reduced the finishing time, by applying the electrolysis into the magnetic abrasive finishing for internal pipe surface was proposed. The details regarding the theory and its differences from the conventional method were explained. In other words, the electrolysis modifies the uneven surface morphology by dissolving the surface and creates oxidation film on the surface. The process transforms the rough surface to a porous aluminum oxide film. Afterward, the MAF plays an important role in removing the film and further finishing the surface. The MAF quickly removes the oxidation film because it is built of the porous structures. With the two processes combined, results in a significant reduction in total finishing time compared to the conventional MAF.

In chapter 3, to study the reliability of the finishing method, the newly developed experimental setup was tested for its machinability. At the same time, the new tool with electrode was developed. Firstly, by using the tool, the experiment was conducted using the conventional magnetic abrasive finishing method without electrolysis. The result had demonstrated the surface roughness of 0.028 µm $R_a$ for 30 minutes of finishing time.

In chapter 4, to study the newly proposed method finishing mechanism, the electrolysis, and magnetic abrasive finishing were conducted in two different steps. In the first step, the electrolysis was conducted, and the oxidation film formed from the process was observed. At the same time, the pit or holes structures formed on the oxidation film. In the second step, the same conventional method of magnetic abrasive finishing was applied to remove the pit with super finishing method. In order to confirm this theory, experiments were carried out. The machining time for two step...
finishing was conducted to determine its influence on the finishing surface. The result showed that surface roughness 0.028 µm $R_a$ was achieved for 2 minutes of electrolysis and 6 minutes of MAF.

In chapter 5, to study further regarding the finishing mechanism, the process was conducted by a simultaneous process of electrolysis and magnetic abrasive finishing. The finishing pattern involves a simultaneous finishing for 2 minutes followed by an independent MAF. Furthermore, the finishing characteristics were studied. Generally, the magnetic abrasive finishing is conducted in a magnetic slurry mixture. On the other hand, the electrolysis process is conducted in an electrolyte. In this experiment, a right amount of electrolyte was added to the magnetic slurry mixture so that both processes could be performed simultaneously. The result showed that the pit formed from the electrolysis and the surface roughness deteriorates when the pit increases. From the result in chapter 4, the machining time needed 6 minutes to remove the pit by MAF. An equal finishing time was conducted revealed that surface roughness 0.047 µm $R_a$ was achieved. A further independent MAF of a total 11 minutes (2 minutes simultaneous with electrolysis and 9 minutes independently) had yielded 0.029 µm $R_a$.

Next, to confirm the machining mechanism, finishing conditions such as magnetic poles gap, abrasives size combinations, etc. were modified and observed on the surface morphology changes were conducted.

In chapter 6, the conclusions were summed up.