PERT Chart Based Laser Cutting Process Control on a Digital Simulation Platform

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The RPV internal structure is a high radio activated part and has very complex geometry. Therefore, it needs to be cut remotely with an automated cutting system to minimize the worker exposures. To do so, we made up the remote laser cutting system with a laser cutter, robot manipulator and control software system and the laser cutter is moved by the robot manipulator based on the command from the control software system.

A laser cutter is required to keep the desired standoff position between the nozzle of the laser cutter and surface of the cut target model to cut properly. Moreover, in the remote cutting process, an exact time and sequence control of the air supply and the laser emission is required for the cutting quality and the process safety.

In this study, we proposed the PERT chart-based process execution and control methodology. The PERT chart is a graph which is represented by nodes and edges. The node of the PERT chart has the information about the activity details such as activity type, execution time and related device. Using the edge we make the sequence of the desired activity execution.

A PERT chart of the cutting scenario is compiled in the control software system to creates data and thread structure to operate the physical device. We built software architecture to interpret and execute the PERT chart efficiently in the digital simulation platform which enables us to use existing pre-built simulation scenario for the laser cutting process.

In addition, we have tested various laser cutting test cases in our test bed to verify the performance of our system. The test bed environment has the shape of the RPV internal structure and is placed under water.

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