Real-Time Process Control
Parameters Affecting the Operational Control of Log Turners

submitted by FPInnovations

FPInnovations is a not-for-profit world leader that specializes in the creation of scientific solutions in support of the Canadian forest sector's global competitiveness and responds to the priority needs of its industry members, colleges, universities, and government partners. It is ideally positioned to perform research, innovate, and deliver state-of-the-art solutions for every area of the sector's value chain, from forest operations to consumer and industrial products. FPInnovations employs more than 525 people. Its R&D laboratories are located in Québec City, Ottawa, Montréal, Thunder Bay, Hinton, and Vancouver, and it has technology transfer offices across Canada.

Among the forest industries it serves, FPInnovations supports the sawmilling industry, a crucial industry in Canada. The sawmilling industry must improve its competitiveness by investing and improving the operational control of its installations and processes. Diagnostic studies carried out by FPInnovations show that the operational control of a given installation varies a lot and that this variation prevents the sawmill from realizing the full potential of processed logs.

The log turner is a machine centre that plays a crucial role in the log breakdown. It rotates a log before it reaches the first cutting machine-centre on the production sawline, in such a way that the position of the log is optimal with respect to the cutting tools. Any deviation between the targeted rotation angle and the actual rotation results in a decrease of the log "value." A log turner works in the following way: a 3D vision system measures the geometric profile of each log and builds a 3D representation of this log. Then an optimizer analyzes the measured profile of each log while taking into account the cutting tools and the priorities of the sawmill products; it determines the rotation maximizing the log value (the "targeted rotation"). Finally the targeted rotation angle is passed on to a Programmable Logic Controller (PLC), which activates the log turner equipment to achieve the rotation.

Diagnostic studies on the performance of log turners reveal that the average discrepancy between the targeted rotation angle and the actual rotation angle is of the order of 25 degrees. This discrepancy results in monetary losses that may be greater than half a million dollars on a yearly basis, for a given sawmill. The positioning error before the log reaches the first cutting machine-centre ("primary positioning") prevents the sawmill from extracting the full potential of the log; it is not possible to make up for this loss later on. The quality of the primary positioning helps optimize the value yielded by each log, at each processing station on the saw line.

The discrepancy between the targeted rotation and the actual rotation is due to many factors, but these can be clustered in the following categories:

1. the geometric characteristics of the logs (diameter, running direction, shape, length, wood knots, etc.);

2. log attributes (tree species, temperature, surface humidity, etc.);

3. operational parameters (running speed, rotation speed, positioning of the log with respect to the curbing rolls, etc.); and finally

4. mechanical conditions of the machines (preventing these machines from carrying out the instructions of the PLC accurately).

The goal of this project is to analyze the operational data pertaining to a specific sawmill and to determine whether (or not) one or several parameters have a significant impact on the performance of the log turner. If such an impact exists, the information gained will be used within the framework of another project in order to improve the operational control of the log turner.