

Research Topic for the ParisTech/CSC PhD Program

***Field (cf. List of fields below): 8** (Materials Science, Mechanics, Fluids)

Subfield: Mechanical Engineering, Wood Sciences, Signal Analysis

Title: Peeling process monitoring: online measurement of wood veneer quality by force, vibration and sound-wave signal analysis

ParisTech School: Arts et Métiers ParisTech

Advisor(s):

Supervising Professor: Pr Philippe Lorong, philippe.lorong@ensam.eu, Arts et Métiers ParisTech, Campus of Paris, PIMM (<http://pimm.ensam.eu>)

Thesis advisors: Louis Denaud, louis.denaud@ensam.eu and Stephane Girardon stephane.girardon@ensam.eu, Arts et Métiers, Campus of Cluny, LaBoMaP, <http://labomap.ensam.eu/>

Short description of possible research topics for a PhD:

Wood peeling process is largely used for plywood, LVL (Laminated Veneer Lumber) and light packaging production. This competitive business requires a complete control of the process. Since wood is a heterogeneous material coming from the living, this objective is challenging and online feedback is required.

Experienced operators are able to detect problems during the peeling process by identifying characteristic sound or vibrations coming from the process. They can adapt lathe's settings to optimize veneer quality mainly described by lathe checks occurrence, veneer thickness variation and veneer surface roughness.

Some preliminary work performed on a laboratory scale has shown the possibility of detecting defects occurrence by vibrational and acoustical analysis [2], [3], [4]. The main objective of this PhD is to develop solutions for industrial applications which could be computed by signal analysis (time, spectral, time/frequency, cepstral...).

The LaBoMaP is currently the only laboratory equipped with an instrumented industrial peeling line (fig. 1) which contained: soaking pool, debarker, peeling lathe equipped with force gauges, laser veneer thickness and surface roughness measuring system, vibration and sound wave measuring system. Moreover, a specific apparatus was developed to fully characterize lathe checks [4] and will be used to verify the reliability of developed solutions. The management of the PhD will be insured by a collaboration between the PIMM and LaBoMaP.



Figure 1 : LaBoMaP Instrumented peeling line

Required background of the student:

Mechanical engineering, acoustic, mechanical vibration, signal analysis, (Wood material and products could be a plus)

Representative publications of the group: (Related to the research topic)

[1] Denaud L., Boukeri A., Krebs M., Butaud J.-C., and Letourneau R. (2015). *Online measurement of veneer lathe checks*. Presented at the 22nd International Wood Machining Seminar, Quebec City, Canada. ISBN: 978-0-9947964-0-0

[2] Denaud L. E., Bleron L., Eyma F., and Marchal R. (2012). *Wood peeling process monitoring: A comparison of signal processing methods to estimate veneer average lathe check frequency*. *European Journal of Wood and Wood Products*, 70(1-3), 256–261.

- [3] Denaud L. E., Bleron L., Ratle A., and Marchal R. (2007). *Online control of wood peeling process: Acoustical and vibratory measurements of lathe checks frequency*. *Annals of Forest Science*, 64(5), 569–575.
- [4] Palubicki B., Marchal R., Butaud J.-C., Denaud L. E., Bleron L., Collet R., and Kowaluk G. (2010). *A Method of Lathe Checks Measurement; SMOF device and its software*. *European Journal of Wood and Wood Products*, 10, 151.