

STSM SCIENTIFIC REPORT

from 26.11. till 04.12.2016 (9 days) of Dr. Ivan Sopushynsky

on the topic “Technical requirements for aesthetical, physical and acoustical tests of resonance wood” in the Laboratory of Mechanics and Civil Engineering (LMGC), University of Montpellier, France

Purpose of the STSM

One of the main purpose of the STSM was to discuss about technical requirements for aesthetical, physical and acoustical tests of resonance wood as the result of wood species diversity and variety of growth conditions of sycamore (*Acer pseudoplatanus* L.) and Norway spruce (*Picea abies* (L)) Karst. The next purposes was addressed to study the methods of wood viscoelastic vibrational properties and to perform some training test with Norway spruce and curly sycamore wood samples as well as to strengthen the research collaboration between Laboratory of Mechanics and Civil Engineering (CMGC), University of Montpellier and Research Section of Wood Science of Ukrainian National Forestry University.

Description of the main results obtained

Within the Short Term Scientific Mission from 26.11.2015 to 04.12.2015 I have participated (1) in the training and the defense of PhD thesis of Capucine Carlier on the topic “An approach of spruce and maple “Resonance wood”: selection criteria and variability of material in Violin making from the points of view of craftsmanship, mechanics, acoustics and sensory perception” and (2) in the presentation of research results of Associate Prof. Eiichi Obataya and Mrs. Nanami Zeniya from Laboratory of Biomaterials Engineering of Life and Environmental Science Tsukuba University (Japan) on the topics (a) *Potential of compressed wood as a damping member of wooden structure*, (b) *Mechanism of shape fixation by steam treatment*, (c) *Changes in vibrational properties of wood due to continuous vibration*, (d) *Physical properties of a reed used for Japanese traditional oboe* and (f) *Effects of heating humidity on the vibrational properties and color of spruce wood used for the soundboard of string instruments*. During this seminar I have presented the research activities of the research section “Wood Science and Forest Products” on the topic “*Figure & Acoustic Wood: Growing trees – Grading – Plantation – Production*”. I had also an opportunity to discuss about “Resonance Wood ” with Prof. Kambiz Pourtahmasi from University of Tehran (Iran), Prof. Eiichi Obataya (Tsukuba University, Japan) and Prof. Katarina Čufar (University of Ljubljana, Slovenia).

The main results were obtained by the study of the testing method estimating wood damping and dynamic Young’s modulus of resonance wood (Annex 1). One radial specimen of spruce wood and one longitudinal specimen of sycamore maple wood were prepared and tested as a training. This equipment is available both in LMG

and BioWooEB Laboratories. In BioWooEB it is installed in a large conditioning room set to standard conditions (20°C, 65%RH), while in LMGC it can be installed in small climatic chambers.

Finally, we have discussed about experimental test of wood damping, dynamic E-modulus, wood density, color variability of wood, tree rings width and latewood percentage that could be fruitfully performed on the following tree species:

- *Acer pseudoplatanus* L.
- *Fraxinus excelsior* L.
- *Picea abies* (L.) Karst.
- *Abies alba* Mill.
- *Alnus glutinosa* L.

This research could be performed early 2017 through a 2nd STSM hosted by BioWooEB in CIRAD.

Future collaboration with host institution

The future scientific cooperation research collaboration between LMGC in University of Montpellier, BioWooEB in CIRAD Montpellier, and Research Section of Wood Science in Ukrainian National Forestry University will be expressed by the planed joint experimental testing of wood resonance properties of *Acer pseudoplatanus* L., *Fraxinus excelsior* L., *Picea abies* (L.) Karst., *Abies alba* Mill., *Alnus glutinosa* L. within a forthcoming STSM of COST Action FP1302 WoodMusICK in a period to be confirmed. The joint analysis of the profiles of LMGC, BioWooEB and Research Section of Wood Science of Ukrainian National Forestry University confirms the need to strengthen the scientific and academic collaboration and to develop the joint research and study projects using the possibility within the program Horizon 2020: ERASMUS+ Student and Staff Mobility KA1.

Foreseen publications/articles resulting or to result from the STSM

The draft version of teaching materials scientific was prepared on the topic “Resonance wood”. The writing of scientific articles is planned after experimental data that will be obtained within the second STSM.

Annex 1

The test includes the following steps (1) turn on electronic (on the back) and check that green light is off; 2) turn on computer and select “Windows XP Professional”; 3) Account: _____ and Password: _____; 4) Open your Excel file with Specimens’ list plus Formulas for calculation; 5) Open “Vybris”; 6) Set the Backup location (C/... Raw Data) and Set the *name* file (Acer or Spruce) than Enter the specimen Name and Check “Zero Capteur” – (a) the laser spot should be very small and bright and (b) the white line should be close to 0. 7. Settings= Amplitude = 2,4 V, Sweep = 15 seconds: for Acer in L direction = sweep 150-750 Hz $Q^{-1}_{inf}=0.95$ $Q^{-1}_{sup}=1.05$ and for Acer in R direction = Sweep = 100-600 Hz $Q^{-1}_{inf}=0.92$ or 0.90 and $Q^{-1}_{sup}=1.08$ or 1.1 .



