BOOK REVIEW

MICROFIBRIL ANGLE IN WOOD

The Proceedings of the IAWA/IUFRO International Workshop on the "Significance of Microfibril Angle to Wood Quality"

edited by B.G. Butterfield

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In recent years, the subject of cellulose microfibrils in wood has attracted considerable interest from wood researchers. Last year's workshop is a testimony to this, with some 45 delegates from 10 nations gathering under the auspices of the International Association of Wood Anatomists and the International Union of Forestry Research Organisations (IAWA/IUFRO) to discuss this highly specific and technical subject. "Microfibril Angle in Wood" is the proceedings from this workshop, held 21–25 November 1997 at Westport in the South Island of New Zealand.

Referring to microfibrils in wood, Butterfield sets forth in the Preface his objective, saying that "... to date there has been no comprehensive account of the techniques available nor a comparison of the results obtained. This volume aims to rectify this."

Did he succeed? In regard to presenting a comprehensive account of the techniques for measuring microfibril angle in wood, I would say that the book does this very well. Almost all the techniques are discussed and compared in considerable detail. One omission was the technique of micro-Raman spectroscopy now being applied to individual pulp fibres (e.g., Pleasants *et al.* 1998). Nevertheless, the detail provided on measurement methods is probably the strength of this book and will be valuable to anyone wanting to set up a measurement system or needing to understand how their own techniques are benchmarked against others. It is unfortunate that there is such large variation in the absolute values of measurements obtained using the various techniques. And this presents an obvious problem where inter-laboratory comparisons are required. Conceivably, there is a role for the IAWA to help facilitate standardisation.

Perhaps selfishly, my own interest was to find experimental evidence confirming the significance of microfibril angle to product quality. In this regard, the actual data presented are quite lean and not overly supportive. This is in contrast to the evidence from finite element and other models which suggests that the relationships should be stronger. As just one example, the editor's own contributed paper reports a correlation of only 0.17 between microfibril angle and wood stiffness for small clearwood matchsticks.

Much of the discussion about microfibril angle pertains to the goal of improving stiffness in lumber from fast-grown plantation forests. Structural grade recovery is a subject of enormous industrial significance in most countries where rotation ages have decreased and

the proportion of juvenile wood being harvested has therefore increased. And New Zealand is no exception. Yet the practical application of knowledge about microfibril angle is unclear from this book. Notwithstanding the fact that current measurement techniques are all frightfully expensive and laboratory based, any application of microfibril angle knowledge must first be considered in context with other proven determinants of log quality and lumber grade recovery—for example, branch index. Sadly, there isn't a mention of branch size or knot area ratio in any of the studies purporting to promote microfibril angle as the *key to interpreting stiffness of timber.*

SAWMOD simulations taken from a report by Cown (1992, p.27) clearly show the deleterious effects of increasing branch size on structural grade recovery (Fig. 1). I am also conscious of the present situation in New Zealand where forests planted with the first generation of genetically improved seed are now reaching a harvestable age. The 5% wood density reduction in many seedlots derived from the 850 series selections (Fig. 2) is creating noticeable effects in industry among producers of machine stress-graded products. Fortunately, the wood density reductions inherent in early breeds have been recovered in later selections.

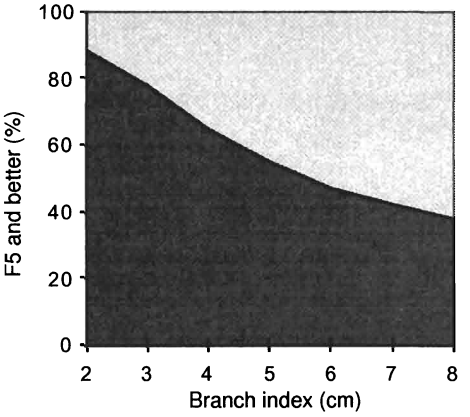

FIG. 1–Effect of branch index on recovery of lumber having machine-stress-grade F5 and better from *Pinus radiata* logs with small-end diameter of 350 mm and average wood density of 400 kg/m^3. Branch index is the average of the largest branch in each log quadrant.

One of the best chapters is the one written by Bob McGraw of Weyerhaeuser. This paper demonstrates the complexity involved in relating microfibril angle to wood performance—in this case longitudinal shrinkage, an important determinant of lumber distortion. Depending upon the growth ring examined, microfibril angle was able to explain between 1% and 41% of the observed variation in longitudinal shrinkage. McGraw summarises by saying:

> "... other factors in addition to S2 microfibril angle are significantly influencing longitudinal shrinkage. These additional factors vary systematically by ring position and height level, therefore causing different longitudinal shrinkage values to occur by ring position and height level, for the same microfibril angle."

The results reported by Les Groom were also fascinating, whereby composite panel stiffness and strength were inversely related to the individual fibre longitudinal mechanical properties.

This book is a welcome addition from the point of view that it is unquestionably the best single collection of information about microfibrils in wood. However, from the point of view

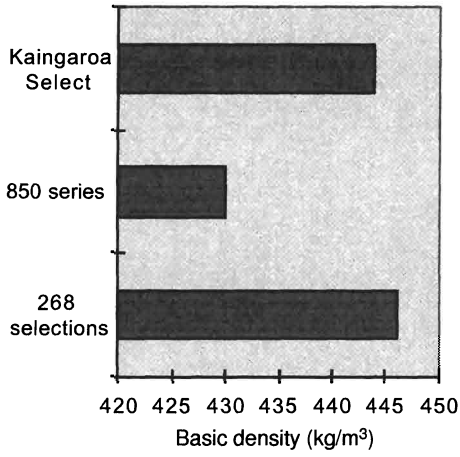

FIG. 2–Breast-height outerwood density for 30-year-old *Pinus radiata* grown in the central north island of New Zealand. Typical values are shown for three genetic materials.

of someone who was unable to attend the workshop, it is disappointing that 10 months after the event all that has been achieved is an unordered collation of non peer-reviewed papers without even basic proof reading.

I would therefore recommend that the book will be most valuable to academics and graduate students of wood quality who have the ability to sort through the detailed chapters and identify the worthwhile information. Like all conferences where papers are volunteered, there are some excellent and very informative papers, but others which are questionable to say the very least. The lack of index and structure to the book will make it difficult for undergraduate students to access information. Also, the book conveys no clear statements of understanding or summary which would help students at this level. And as for practising wood technologists and foresters working in industry, I would suggest that they too will find little of practical value. The book raises more questions than it answers—which is clearly a reflection of our present understanding—and unfortunately the answers that do exist require considerable digging and analysis by the reader to find.

All told, the organisers of the workshop should be thanked for their efforts. The study of cellulose microfibrils in wood is clearly a specialist area, but one which is claimed to have the potential to have a wider impact upon forestry. And with the growing number of X-ray diffraction systems being used to measure the microfibril angle, the meeting was both worthwhile and timely. The availability of the conference proceedings to scientists who were unable to travel to Westport is also helpful.

REFERENCES

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PLEASANTS, S.; BATCHELOR, W.J.; PARKER, I.H. 1998: Measuring the fibril angle of bleached fibres using micro-Raman spectroscopy. *Appita 51*: 373–376.

Brad Ridoutt