



.....
«MIP: Engineering-2020: Modernization, Innovations,
Progress: Advanced Technologies in Material Science,
Mechanical and Automation Engineering»
.....

«Laser airborne reflection method for remote sensing
forest species composition»

M L Belov, A M Belov, V A Gorodnichev and S V Alkov

Problem statement

- Remote aerospace monitoring of large forestlands
- Sensing the forest sites with dominant needle-leaved or broadleaved tree species
- Sensing the forest sites at any time of the day or night in a wide range of weathering conditions
- Sensing the forest sites in the eye-safe spectral bands

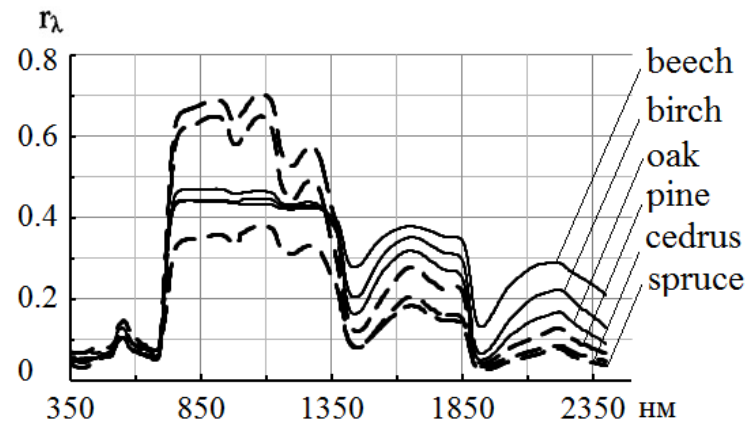


Figure 1. Reflection coefficients of tree species.



Solution methods

- Reflection spectra of broadleaved tree species differ from those of the needle-leaved ones in spectral bands 1500 – 1800 nm and 2050 – 2300 nm
- We use a ratio R of the reflection coefficients of plants at two wavelengths 355 nm and 2100 nm

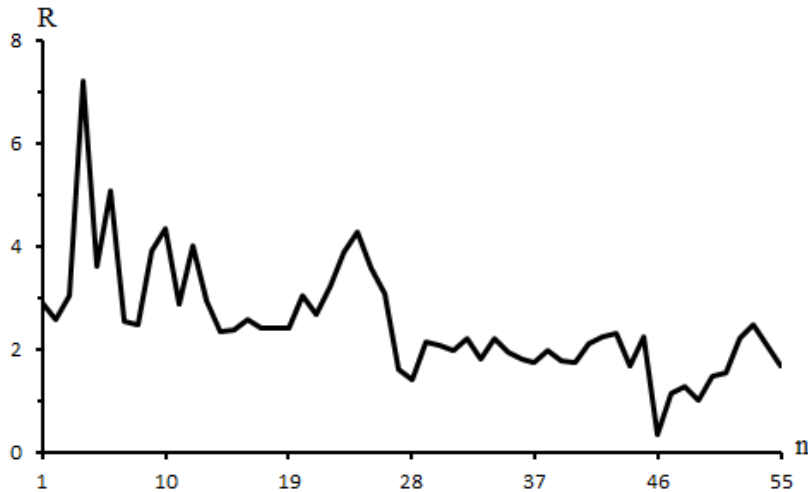


Figure 2. R values at 355 and 2100 nm for trees.

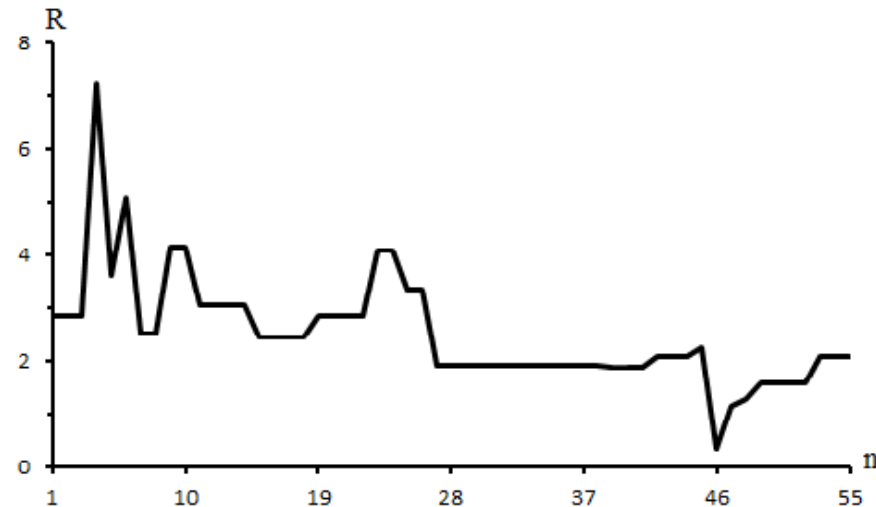


Figure 3. R values at 355 and 2100 nm for trees after averaging.

The item numbers 1-26 (figures 2, 3) are broadleaved trees in summer season. The item numbers 27-55 (figures 2, 3) are needle-leaved trees in summer season.



Table 1. Probabilities of the correct detection P_d and the false alarm P_a for the sensing wavelengths 355 nm and 2100 nm (δ – noise relative mean square deviation)

δ (%)	P_d	P_a
1	0.99	<0.01
3	0.96	0.06
5	0.94	0.07
10	0.89	0.12

Table 2. Probabilities of the correct detection P_d and the false alarm P_a for the sensing wavelengths 355 nm and 2100 nm after averaging

δ (%)	P_d	P_a
1	1	0
3	0.99	<0.01
5	0.96	0.01
10	0.93	0.04

Conclusions

- Statistical modelling of the correct detection and false alarm probabilities has been implemented to identify dominant (needle-leaved or broadleaved) tree species through laser sensing in the UV and NIR spectral bands
- It is shown that the laser method of monitoring at eye-safe wavelengths 355 and 2100 nm wavelengths allows sensing dominant needle-leaved or broadleaved tree species with a probability of correct detection close to one and a probability of false alarm ~ second decimal places
- The method using two eye-safe sensing wavelengths can be used for airborne forest monitoring

Contacts

M L Belov, A M Belov, V A Gorodnichev and S V Alkov

Bauman Moscow State Technical University (BMSTU), 2nd Baumanskaya str. 5,
Moscow, Russia 105005

E-mail: belov@bmstu.ru

II INTERNATIONAL CONFERENCE
KRASNOYARSK, RUSSIA
16-18 April 2020

«MIP: Engineering-2020: Modernization,
Innovations, Progress: Advanced Technologies in
Material Science, Mechanical and Automation
Engineering»