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Reflection of sound from a forest: Effective tree spacing for a scattering model with a single line of cylinders

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A scattering model for the reflection of sound at forest rims is presented by the authors in another contribution to this conference. The forest is thereby modelled by a single row of cylinders with the effective spacing as single free parameter. In the present article an engineering scheme for this effective tree spacing is presented. The scheme is based on results of numerical calculations with the Euler model for sound propagation in a model forest consisting of cylinders. The numerical results show that forests are widely transparent for incoming as well as reflected sound waves. Multiple reflections can be neglected. Reflections from trees deep inside the forest experience additional propagation attenuation and are therefore weakened relative to contributions from trees in the first row. Apart from geometrical spreading foliage attenuation is the most prominent effect. The penetration depth of the forest reflection is proportional to the wavelength. The frequency dependent penetration depth is derived by means of a statistical analysis for numerous situations. Assuming the effective tree spacing to be inversely proportional to the penetration depth, the engineering scheme for the effective tree spacing is derived. Comparisons of the frequency response with measurements show good agreement.