

## BEAM TRACING FOR MIGRATION AND INVERSION (C-41)

J.T. FOKKEMA<sup>1</sup>, S.R.G. KREMER<sup>2</sup> and C.P.A. WAPENAAR<sup>2</sup>

Wavefield extrapolation operators play a key role in seismic migration and inversion schemes. Both the forward and inverse extrapolation operators can be formulated in terms of one-way Kirchhoff integrals that contain forward- or backward-propagating Green's functions, defined in a geologically-oriented macromodel of the subsurface. For complicated macromodels these Green's functions must be computed numerically by a forward-modelling scheme. In this paper, we propose beam tracing as an accurate and efficient solution for generating Green's functions. Generally speaking, a beam can be characterized by its central axis and the beam-width. The central axis is the raypath that follows from the high-frequency acoustic approximation. The beamwidth is, in fact, given by the window function that permits the acoustic field to be decomposed into separated spatial contributions, known as beams. It will be shown that, using the boundary-integral representation for the field in a medium, the reflected and transmitted field for an arbitrary curved interface can be written as the spatial convolution of this window function and the field at the interface. The curvature of the interface determines the number of beams to evaluate. Using the Gaussian window function for the incident field, it follows directly, by the transform property of this function, that the spatial character of the window function after scattering is preserved. This class of window functions leads to Gaussian beams. From the present analysis, it is clear that the number of beams is determined by the complexity of the subsurface and that an a priori restriction to a certain class of window function is not necessary. Furthermore, this general representation allows for a redefinition of the beam decomposition at every interface. Finally, whatever the choice of the window function, in the high-frequency approximation it converges to the conventional acoustic ray approximation.

<sup>1</sup>Delft University of Technology, Department of Mining Engineering, Section Technical Geophysics, P.O. Box 5028, 2600 GA Delft, The Netherlands.

<sup>2</sup>Delft University of Technology, Laboratory of Seismics and Acoustics, P.O. Box 5046, 2600 GA Delft, The Netherlands

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