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Gaussian beam tracing for high-frequency acoustics

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Gaussian beam tracing is an approach that constructs full-wave beams around the skeleton of conventional ray theory. This Gaussian beam approach leads to a very simple algorithm and provides remarkable accuracy and speed. For high-frequency, broadband applications, Gaussian beams are often the only practical approach, as the standard full-wave modeling alternatives are often thousands of times slower. Gaussian beams are derived using high-frequency asymptotics, and therefore fit naturally to certain current areas of interest in HF acoustics, such as acoustic communications. However, what often surprises people who are not familiar with the technique is that it works quite well at lower frequencies, depending on the water depth. That fact, is really a consequence of 20 years of continued advances in the Gaussian beam method. We will review those developments in the context of HF variability, considering effects of boundary, volume, and source/receiver dynamics.