ACOUSTICS2008/3013
An optimized source transmission scheme based on pressure sensitivity kernels

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A first-order Born approximation is used to obtain the pressure sensitivity of the received signal to small changes in medium sound speed. The pressure perturbation to the received signal caused by medium sound speed changes is expressed as a linear combination of single-frequency sensitivity kernels weighted by the source signal in the frequency domain. This formulation is used to optimize the pressure sensitivity kernel to give a new source transmission that can produce a focal spot and at the same time, to have less sensitivity to sound speed fluctuations than time-reversal. The formulation allows for a trade-off between quality of focal spot and sensitivity to environmental fluctuations. The optimized new source transmission uses knowledge of the medium statistics and is related to the regularized inverse filter.