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Modeling bottom penetration for buried target detection

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Sonar detection of targets buried in underwater sediments has been found to be complicated by surface roughness. In particular, current-induced ripples can diffract energy down into sandy sediments to enhance buried target detection at shallow sonar grazing angles. To validate these effects, models encompassing the dominant propagation mechanisms as well as faithfully representing the target in the environment have been used. This paper describes our efforts to adapt transition matrix and perturbation theory models to provide realistic predictions of buried target response for spherical and cylindrical shapes. Combining these models of scattering and penetration required adopting some approximations to reduce computation time while retaining accuracy. Steps taken to verify and exercise the resulting models reveal some sensitivities that accentuate the need for accurate environmental and set-up ground truth for validation of detection mechanisms. [Work supported by the Office of Naval Research and the Strategic Environmental Research and Development Program, USA.]