MASTER OF SCIENCE
IN
ENGINEERING ACOUSTICS

NUMERICAL ANALYSIS OF BOTTOM REVERBERATION AND THE INFLUENCE OF DENSITY FLUCTUATIONS

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The influence of density fluctuations on both interface and volume reverberation will be numerically examined in this work. Using the same reverberation geometry and environmental parameters as defined in previous works, several numerical analyses will be conducted for continuous wave (CW) signal to predict mean reverberation structures and for broadband pulse signals to generate complex reverberation structures in the time-domain. The reverberation model is based on the parabolic equation (PE) approximation. Scattering is assumed to be dominated by small-scale Bragg scatter while the propagation modeling, based on a well-documented PE model, incorporates multipath effects due to larger range-dependent structures. The incorporation of density fluctuations in the PE model is a new approach. It was observed that the influence of bottom volume density perturbations is to reduce later (long-range) levels relative to earlier levels but does not appreciably affect the structure. It was also noted that the CW analysis is unable to capture coherent structure of volume RPL due to inability to resolve multipath influence. Therefore, the vertical correlation analysis is only valid for broadband pulse calculations. From broadband correlation calculations, the volume reverberation may decorrelate more rapidly than interface reverberation. Additionally, spectral analysis of the signals suggested that response of interface reverberation is flatter with a slope on the order of –0.125 for both CW and broadband data. Volume reverberation displayed a –0.75 slope for CW and –0.25 slope for broadband.

KEYWORDS: Shallow Water Reverberation, Reverberation Pressure Levels, Vertical Coherence, Power Spectral Density, Power Ratio Spectral Density