

Chapter 1

Geometry and Signal Statistics

1.0.1 Introduction

In this chapter, the signals present on the elements of a MASB sonar system are examined, signal correlations are developed between elements, and the full covariance matrix is defined for multiple incoming plane waves. Included in this analysis is a contribution from noise in the system.

1.1 Sonar Footprint: The Backscattered Signal Component

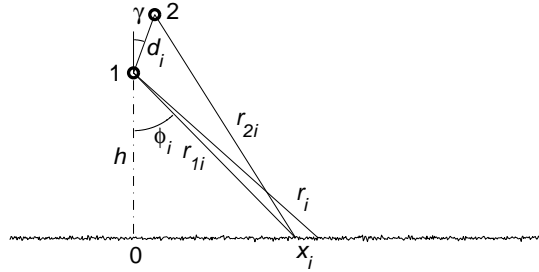


Figure 1.1: Geometry for footprint. In this scenario, a pulse is transmitted from element 1, travels outward, scatters off of the bottom and some of this scattered signal is backscattered toward each of the array elements. Due solely to time of flight, the signal received on different elements at the same time corresponds to slightly different locations on the bottom.

1.2 Geometry of Simple Bathymetric Measurement

In this section, the geometry of a bottom mapping system that uses MASB is defined. To map the bottom using an MASB system, a finite length pulse is transmitted from location 1 in fig. 1.3. The pulse then travels along the path shown as r_{1i} to the bottom at x_i , and ensonifies the footprint area,