Model Air –To-Water sound Transmission by airborne rapid moving source

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In this paper, we give a fast calculation method that is used to calculate the temporal received signal for a rapid uniformly moving acoustic source in stratified media. Schmidt had given a spectral representation for Doppler-shifted acoustic field in stratified media. Because the time and wave number k_x k_y is coupled through the argument to the exponent function, two–dimension wave-number integration is needed for each individual time. So the calculation amount of time domain solution is large, and Schmidt suggested solution in frequency domain. But, when receiver is not far away from source, received signal will be highly dynamic in amplitude and frequency. The solution in time domain is more preferable. In this paper, we give a fast calculation method for time domain two-dimension wave-number integration. Firstly, the coordinate is rotated, and time and wave number k_y is decoupled. Then quick Chirp z transform is used to calculate the k_x integration, and the temporal signal at all discrete time sample is got at one time. Since the wave-number integration method can be used to model air to water sound transmission directly, we calculated the received signal in shallow water and deep water excited by an airborne rapid moving source. The result showed that the signal amplitude and frequency change quickly when receiver is in deep water, and signal amplitude fluctuate quickly when receiver is in shallow water. When range separation between source and receiver is large during the interested time, one-dimension wave-number integration method has been got by means of stationary phase method. The calculation result of one-dimension wave-number integration method was compared with that of two-dimension wave-number integration method.