This thesis presents a detailed description of the Composite Gauss-Legendre quadrature method adopted for solving the nonlinear wave-wave interaction problem or nonlinear source term of the wave model due to Hasselmann (1962), to serve as a basis for better understanding and further research studies. It can be considered as a research model and is mainly aimed at providing a complete method using the properties of Dirac Delta function and application of the quadrature method.

In its full form, the nonlinear source term is a 6-D resonant integral. To solve this integral, it is essential to obtain the wave resonating quadruplets responsible for the contribution of the integral. Details regarding the polar method for obtaining the wave resonating quadruplets in both deep and finite depth cases, developed recently for solving the nonlinear problem are presented in Prabhakar and Pandurangan (2006a).

The motivation in applying Gauss-Legendre quadrature method to the nonlinear problem is due to the many advantages quadrature methods possess. One of the many advantages is the fact that quadrature methods are global spectral methods and hence accuracy can always be improved. The singularities that may arise in the nonlinear problem can be avoided with this use of the quadrature method.
The nonlinear source term is solved on an input polar grid in the wave number / frequency space. It needs another input polar grid which may either be taken same or different. The present method employs different input polar grids. It differs from the existing Webb-Resio-Tracy (WRT) method in which the input polar grids are considered same and hence more number of points needs to be considered.

Although the quadrature method is a general one, it is applied to the deep water case, using scaling relations, analogous to the existing works. This method is especially attractive when studying the nonlinear problem at less number of points in the polar grid. A procedure for obtaining the 1-D nonlinear source term at more number of frequency points in the polar grid is also presented. A comparison study of the 1-D nonlinear source term with results of exact methods, indicate that the present results are comparable and qualitatively in good agreement with WRT method with minor differences at higher frequencies.

The present quadrature method can be improved and could well serve for further research work on the nonlinear problem.