Difference methods for solving wave based acoustic models have been of continued interest and development since early work by key figures such as Bottledooren~\cite{Botteldooren1995}, as these methods can provide a simple and flexible approach for simulating a wide range of acoustic phenomena.

The nature of many time domain difference methods present significant computational resource requirements, as the size, sampling rate and inherent stability of the simulation has a distinct impact on the memory and execution time required for the simulation to give a satisfactory result.

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In this study the execution speed is analysed, for variations of the finite difference time domain method that have been implemented in Matlab.

It is suggested that leveraging techniques to minimise the total number of computations per time step,

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Some distinct disadvantages to these methods mean that they are often only implemented for low frequency modelling, and in hybrid schemes such as the one presented by Mourik and Murphy~\cite{Mourik2014a}.

1.

In this study the execution speed of three difference methods are explored; the finite difference time domain method, the sparse finite difference time domain method and the psudospectral time domain method.

The execution times for these three methods are evaluated in domains of varying size, using commonly available computing resources. It is found that the pseudospectral time domain method is the fastest per time step of the three methods, when solving for very large domains i.e. millions cells in volume. This is potentially due to the nature of differentiation by multiplication in the frequency domain.

1. Ray based acoustic modelling methods may be little more efficient when modelling multiple sources and receivers in large domains, as the number of rays required for accurate simulation can become very large.