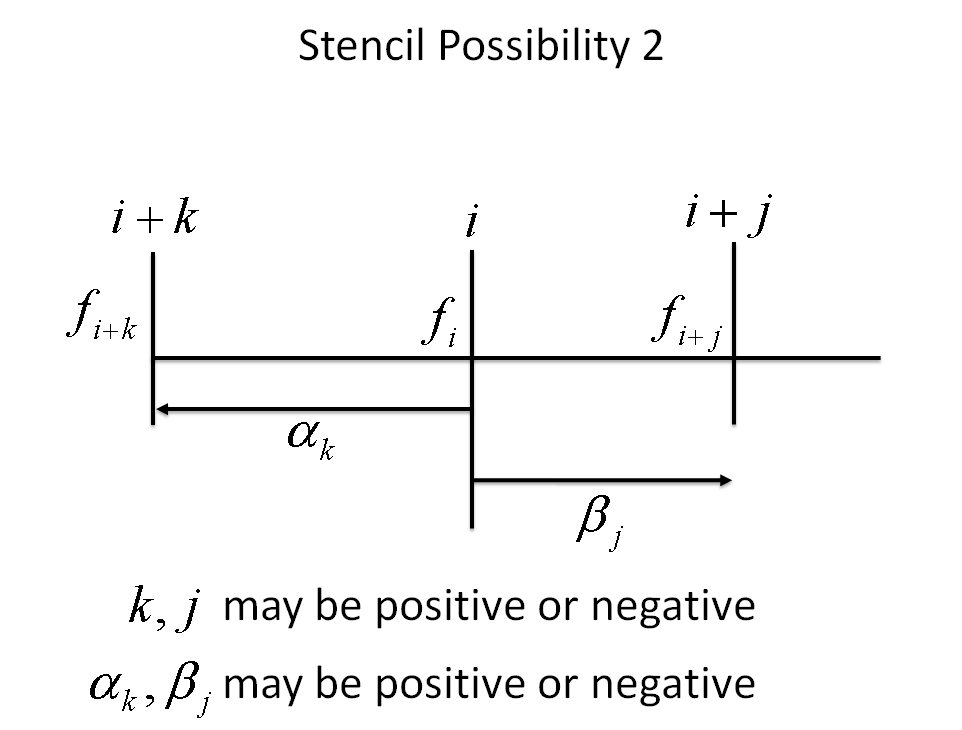
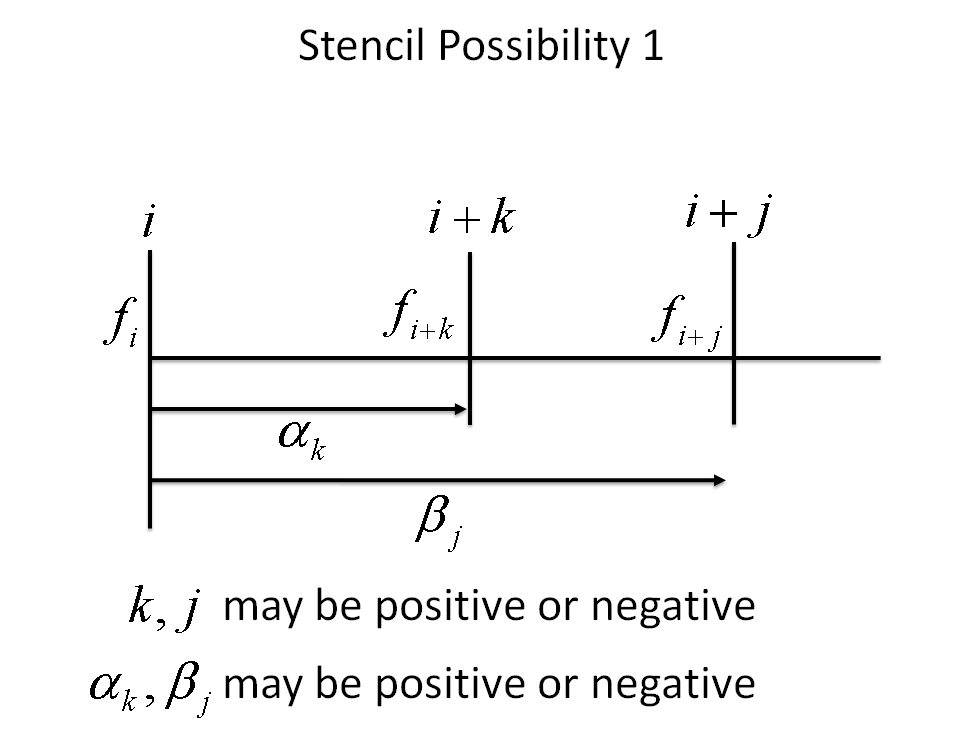
Non-uniform grid stencils results

This document contains the results and examples of the 1st and 2nd derivative of a function using function values at locations , and with respective indexes. Below are diagrams of the possible stencils that may be made from the results of this document. The following analysis is valid for non-uniform grids.



# Results

These results were obtained by solving the following system of equations

## 1st derivative

Solving for for BCs

## 2nd derivative

# Examples - 1st derivative

## Example 1 (central difference)

Let

This results in

The order of accuracy should be

Which is the 2nd order accurate, first derivative central differencing equation. Note that the indexes and should be and respectively.

## Example 2 (forward difference)

Let

This results in

The order of accuracy should be

Which is the 2nd order accurate, first derivative forward differencing equation.

# Examples - 2nd derivatives

## Example 1 (central difference)

Let

This results in

Which is the 2nd order central difference scheme.

## Example 2 (forward difference)

Let

This results in

Which is the 2nd order forward difference scheme.

## Example 3 (non-uniform grid)

The diffusive terms may be written as

Factoring terms

First term

Returning

Let

Substituting

This is the same form of the equation that I've derived.