

## Chapter II-6 — Multidimensional Waves

### Overview

Chapter II-5, **Waves**, concentrated on one-dimensional waves consisting of a number of rows. In Chapter II-5, **Waves**, the rows were referred to as “points” and the symbol p stood for row number, which was called “point number”. Scaled row numbers were called X values and were represented by the symbol x.

This chapter now extends the concepts from Chapter II-5, **Waves**, to waves of up to four dimensions by adding the column, layer and chunk dimensions. The symbols q, r and s stand for column, layer and chunk numbers. Scaled column, layer and chunk numbers are called Y, Z and T values and are represented by the symbols y, z and t.

We call a two-dimensional wave a “matrix”; it consists of rows (the first dimension) and columns (the second dimension). After two dimensions the terminology becomes a bit arbitrary. We call the next two dimensions “layers” and “chunks”.

Here is a summary of the terminology:

Dimension Number	0	1	2	3
Dimension Name	row	column	layer	chunk
Dimension Index	p	q	r	s
Scaled Dimension Index	x	y	z	t

Each element of a 1D wave has one index, the row index, and one data value.

Each element of a 2D wave has two indices, the row index and the column index, and one data value.

Each element of a 3D wave has three indices (row, column, layer) and one data value.

Each element of a 4D wave has four indices (row, column, layer, chunk) and one data value.

### Creating Multidimensional Waves

Multidimensional waves can be created using the Make operation:

```
Make/N= (numRows, numColumns, numLayers, numChunks) waveName
```

When making an N-dimensional wave, you provide N values to the /N flag. For example:

```
// Make a 1D wave with 20 rows (20 points total)  
Make/N=20 wave1
```

```
// Make a matrix (2D) wave with 20 rows and 3 columns (60 elements total)  
Make/N=(20, 3) wave2
```

The Redimension operation's /N flag works the same way.

```
// Change both wave1 and wave2 so they have 10 rows and 4 columns  
Redimension/N=(10, 4) wave1, wave2
```

The operations InsertPoints and DeletePoints take a flag (*/M=dimensionNumber*) to specify the dimension into which elements are inserted. For example:

```
InsertPoints/M=1 2,5,wave2 //M=1 means column dimension
```

This command inserts 5 new columns in front of column number 2. If the /M=1 had been omitted or if /M=0 had been used then 5 new rows would have been inserted in front of row number 2.

You can also create multidimensional waves using the Make operation with a list of data values. For example:

```
// Create a 1D wave consisting of a single column of 3 rows  
Make wave1 = {1, 2, 3}
```