7.1 BLA and Matrices: What and Why

A 1-dimensional problem (e.g. one that can be represented by a simple line or curve) is called a scalar problem, while an n-dimensional problem is a vector problem. Basic Linear Algebra (BLA) and matrices apply whenever there are vector problems. This Section considers the following issues:

- What are they, and why should I care?
- Example: Convenience and notation
- Example: The covariance matrix in VaR
- Example: Forecasting and "Solutions" (projections and intersections)

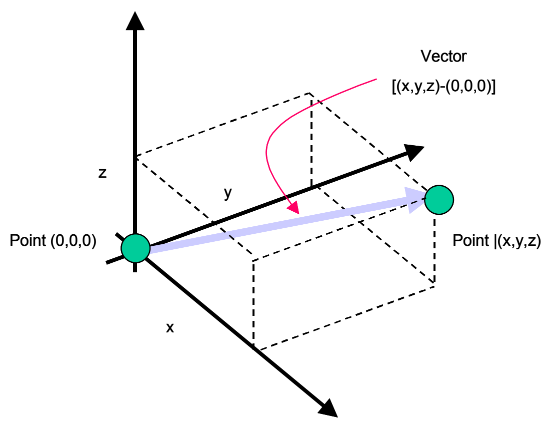
7.1.1 Vectors, Arrays, and Matrices

Vectors and matrices arise any time there are multi-dimensional processes or representations. For example, they will arise with multi-asset problems, or even single asset problems with multiple "factors". For example, a term-structure representation to value an IR derivative may employ a multi-factor representation of the yield curve, or a convertible bond may be priced with multiple factors relating to IRs, equities, and possibly other factors such as FX, credit, and so forth.

Each dimension in the process is represented by a "row" in a matrix. For example, the location or "address" of a point in 3-space is:

$$Location = \begin{bmatrix} x \\ y \\ z \end{bmatrix} \quad (7.1)$$

This is a 1-dimensional matrix representation. 1-dimensional matrices are usually referred to as vectors. Many definitions also present a vector as "something" with both "magnitude[321] and direction". The image to right shows both the "location" perspective (as illustrated by coordinate address of the point), and the "vector" perspective (as illustrated by the arrow that has magnitude (i.e. length) and direction). Thus, these are complementary views of the same idea.



[321] The interpretation of "magnitude" as a measure of "speed" is common in physics, where, say, an airplane's or sub–atomic particle's vector describes its speed and direction.