FFC User Manual

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http://www.fenics.org/ffc/

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1 Introduction

This is a first draft for a manual for FFC manual. Contributions are most welcome.

2 Installation

In preparation.

3 Reference elements

3.1 The reference triangle

The (Figure 1) is defined by the following three vertices:

$$\begin{aligned} v^0 &= (0, 0), \\ v^1 &= (1, 0), \\ v^2 &= (0, 1). \end{aligned} \tag{1}$$

Note that this corresponds to a counter-clockwise orientation of the vertices in the plane.

The edges of the reference triangle are ordered following the convention that edge e^i should be opposite to vertex v^i for $i = 0, 1, 2$.

The vertices of each edge are ordered following the counter-clockwise orientation of the triangle:

$$\begin{aligned} e^0 &= (v^1, v^2), \\ e^1 &= (v^2, v^0), \\ e^2 &= (v^0, v^1). \end{aligned} \tag{2}$$

3.2 The reference tetrahedron

The (Figure 3) is defined by the following four vertices:

$$\begin{aligned} v^0 &= (0, 0, 0), \\ v^1 &= (1, 0, 0), \\ v^2 &= (0, 1, 0), \\ v^4 &= (0, 0, 1). \end{aligned} \tag{3}$$

The faces of the reference tetrahedron are ordered following the convention that face f^i should be opposite to vertex v^i for $i = 0, 1, 2, 3$.

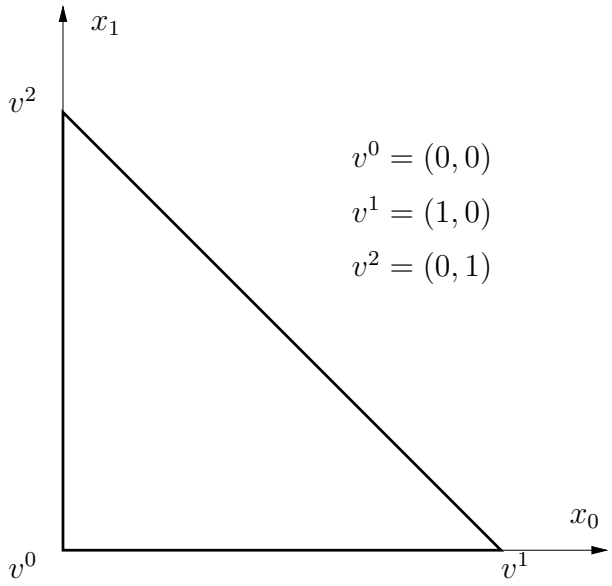

Figure 1: Physical coordinates of the reference triangle.

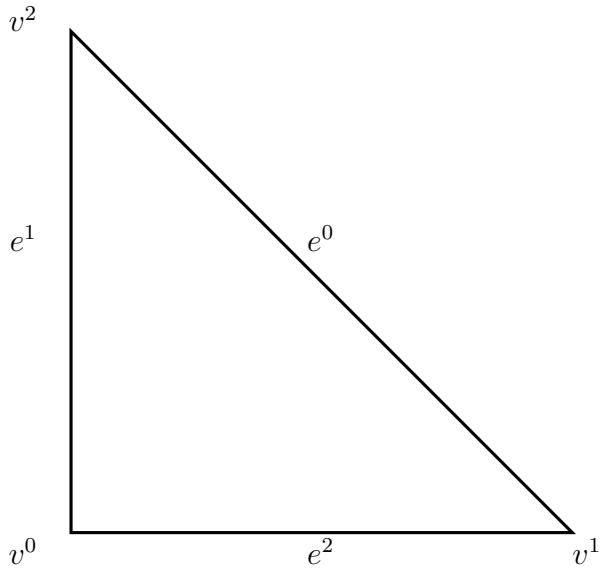

Figure 2: Ordering of mesh entities (vertices and edges) for the reference triangle.

The edges of the reference tetrahedron are ordered following the convention that edges e^0, e^1, e^2 should correspond to the edges of the reference triangle. Edges e^3, e^4, e^5 all ending up at vertex v^3 are ordered based on their first vertex (v^0, v^1, v^2).

The same convention gives an ordering for vertices of each edge:

$$\begin{aligned} e^0 &= (v^1, v^2), \\ e^1 &= (v^2, v^0), \\ e^2 &= (v^0, v^1), \\ e^3 &= (v^0, v^3), \\ e^4 &= (v^1, v^3), \\ e^5 &= (v^2, v^3). \end{aligned} \tag{4}$$

The edges of each face are ordered following the convention that the vertices of face f^i are given by $v^{i+1 \mod 4}$, $v^{i+2 \mod 4}$, $v^{i+3 \mod 4}$, which gives the following ordering of edges:

$$\begin{aligned} f^0 &= (e^5, e^4, e^0), \\ f^1 &= (e^3, e^1, e^5), \\ f^2 &= (e^2, e^4, e^3), \\ f^3 &= (e^0, e^1, e^2). \end{aligned} \tag{5}$$

Note that the ordering of edges on $f^3 = (e^0, e^1, e^2)$ is the same as the ordering of edges on the reference triangle.

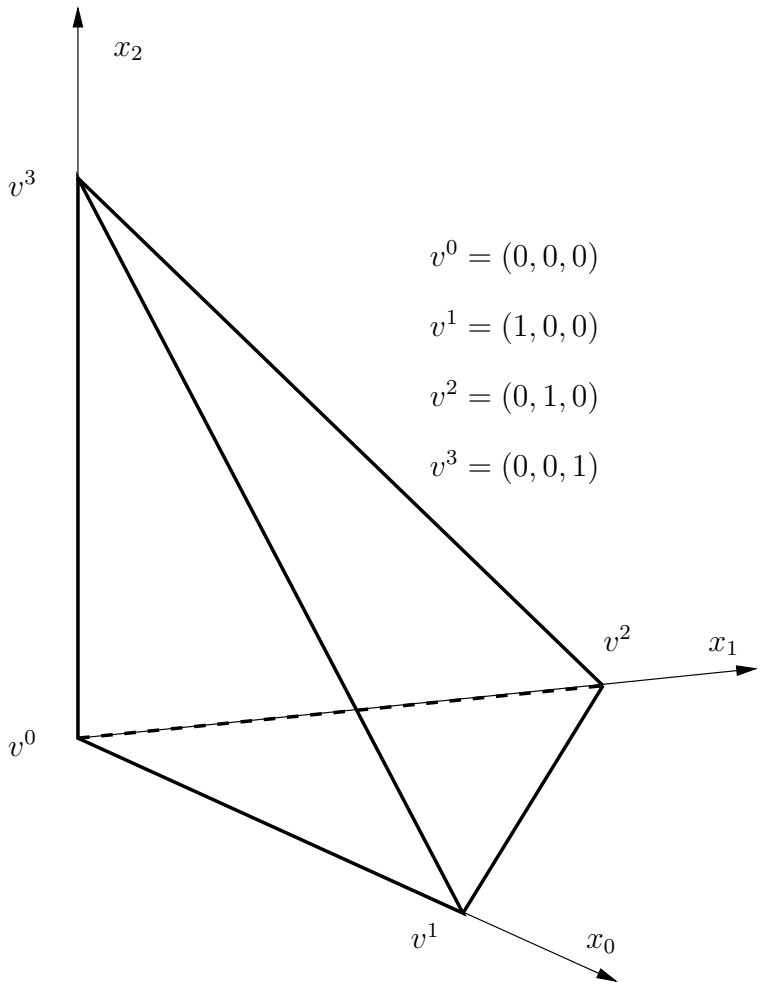

Figure 3: Physical coordinates of the reference tetrahedron.

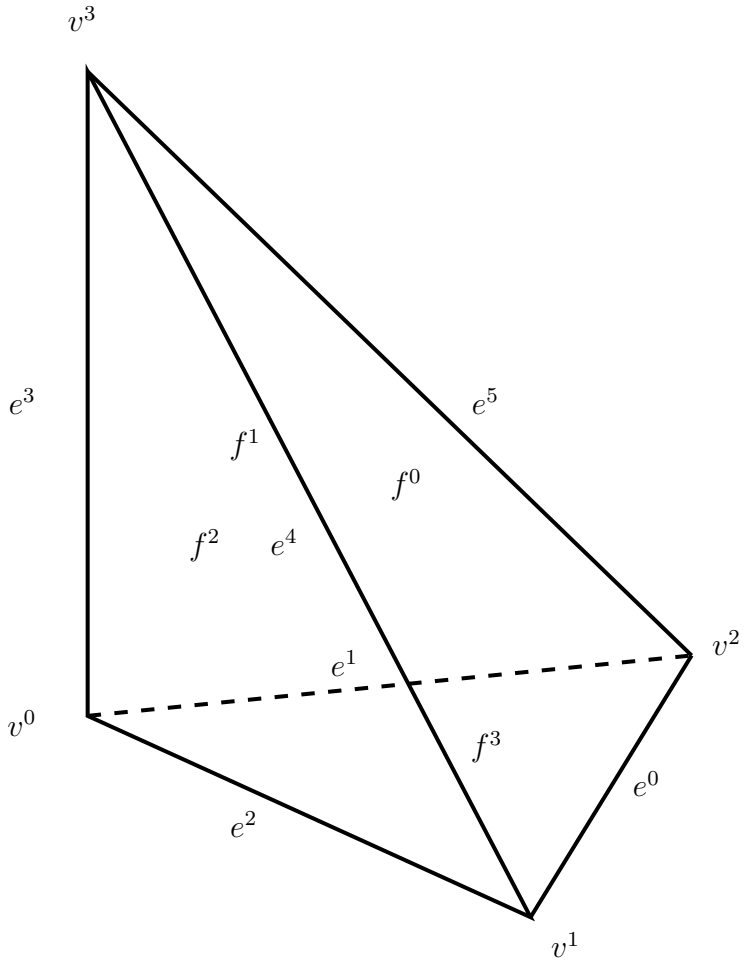

Figure 4: Ordering of mesh entities (vertices, edges, faces) for the reference tetrahedron.

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