Let C0 ={SUM (*i* = 1 to *p*)ε*ivi*│ε*i* is an element of **F**2, *vi* is an element of V(G)}

be the vector space of 0-chains

and

Let C1 ={SUM (*i* = 1 to *q*) ε*iei*│ε*i* is an element of **F**2, *ei* is an element of E(G)}

be the vector space of 1-chains

Recall the linear transformations

*boundry* ∂ : C1 → C0 defined by ∂(*uv*) = *u* + *v* and

*coboundary* δ: C0 → C1 defined by δ(u) = SUM *ei*, where *ei* is adjacent to *v*.

Let Z(G) = { *x* an element of C1│∂(*x*) = 0} be the cycle space of G

and

Let B(G) ={ *x* an element of C1│there exists *y* an element of C0, *x* = ∂(*y*)} be the coboundary space of G.

1. Find matrices representing the linear transformations ∂ and δ.
2. Define an inner product on C1 by < *x,y* > = SUM ε*iηi*, where *x* = SUM ε*iei* and y = SUM *ηiei*.

Prove that *x* is an element of Z(G) iff < *x,y* > = 0 for all *y* element of B(G)

1. Show that the dimensions of B(G) is *p* – *k*(G).
2. Characterize the class of graphs for which B(G) = C1(G)

Cycle Basis: Is a basis of cycle space consisting only of cycles.

Example:

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| C1  | C2 | (Imagine this is 2 closed boxes next to each other)

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Cycle space: {0, C1, C2, C1 + C2}

{ C1, C2 } Form a Cycle Basis