The intermediate voltage, i.e. the voltage for the EMU is:

$$U_1 = \frac{\frac{1}{j\omega C_2}}{\frac{1}{j\omega C_1} + \frac{1}{j\omega C_2}} \times U = \frac{C_1}{(C_1 + C_2)} \times U$$

$n_c = \dfrac{C_1 + C_2}{C_1}$ is the voltage ratio of the capacitor

The ratio of the EMU is defined according to the same rules as for inductive voltage transformers:

$$n_t = \frac{N_1}{N_2} = \frac{U_1}{U_2}$$

Total ratio, from high voltage side of CVD to secondary side of EMU:

$$n_{tot} = n_c \cdot n_t = \frac{U_1}{U_2} = \frac{C_1 + C_2}{C_1}$$

This is same as for inductive voltage transformers, only difference is the capacitance C_e in series with the primary winding.

1.4.2 The CVT at no-load

Using the equivalent circuit, the properties of a CVT is easiest studied in a vector diagram. See Figure 1.21. The square represents the limits for an accuracy class.

The location of the point *N-L*, the no-load voltage drop is determined by the losses of the transformer and the total resistance in the primary winding and reactor.

Figure 1.21 shows a CVT without turn correction, where the no-load point is located at a small negative ratio error and a small positive phase displacement. To keep the phase displacement at no-load at a minimum, the major part of the inductive compensation reactance of the EMU must be in the primary circuit so the excitation current flows through a tuned circuit.

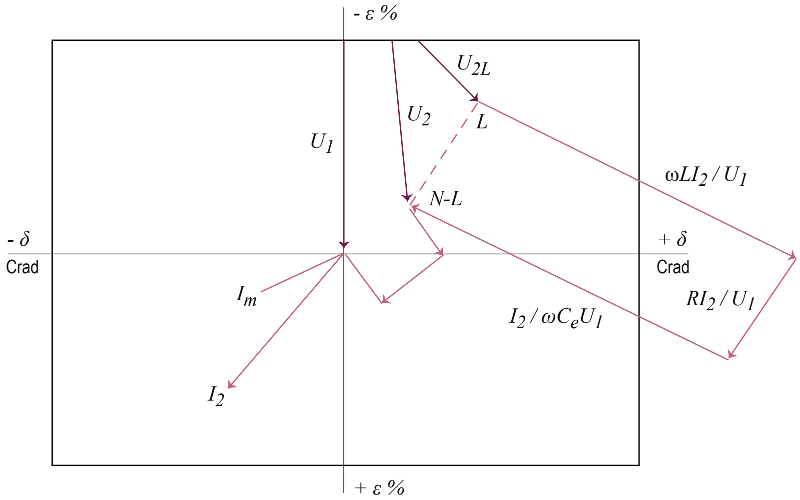

Figure 1.21

1.4.3 The CVT at load

When the transformer is loaded with an impedance, an additional voltage drop occurs in the circuit due to the load current. The location of the load point L is determined by the same parameters as the no-load point plus the impedance in the secondary circuit.

The ratio n_t of the transformer influences the voltage drop in the primary circuits, since the load current in the primary winding is determined by the ratio. A high intermediate voltage is an advantage since it will reduce the current and give better properties to the EMU.

Like for an inductive voltage transformer, the CVT will always have a negative ratio error. Turns correction is therefore always made in order to use also the positive half of the accuracy class. Since the accuracy shall be maintained from 25% of rated burden it is possible, by turns correction, to place the no-load point outside the accuracy class.

Turns correction is just a parallel movement of the vector diagram in direction of ratio error. See Figure 1.22.

An increased positive ratio error is obtained by a reduction of the primary turns. Turns correction is easily made due to the large number of turns.