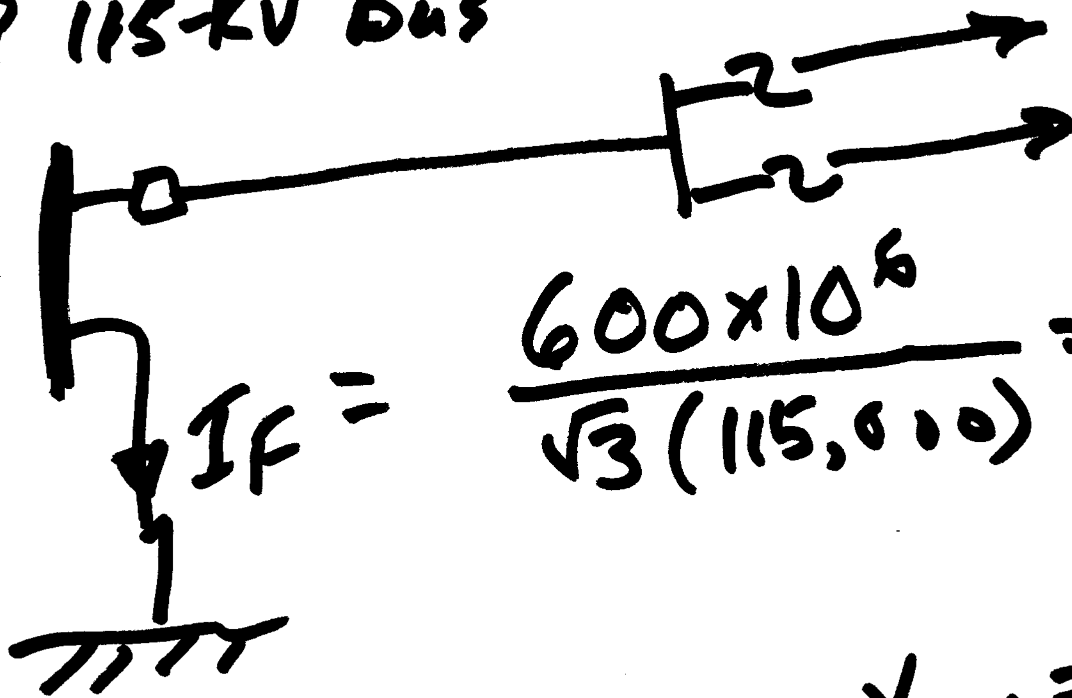
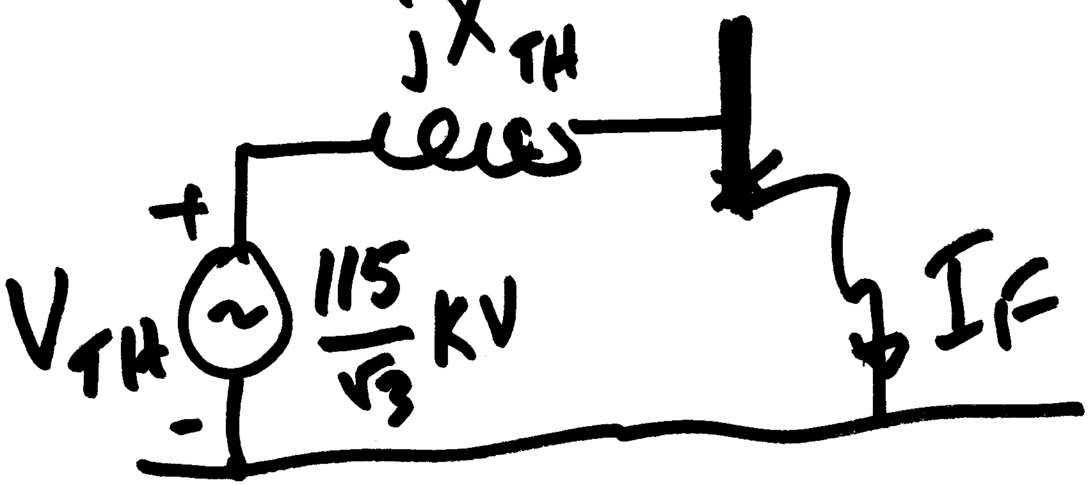
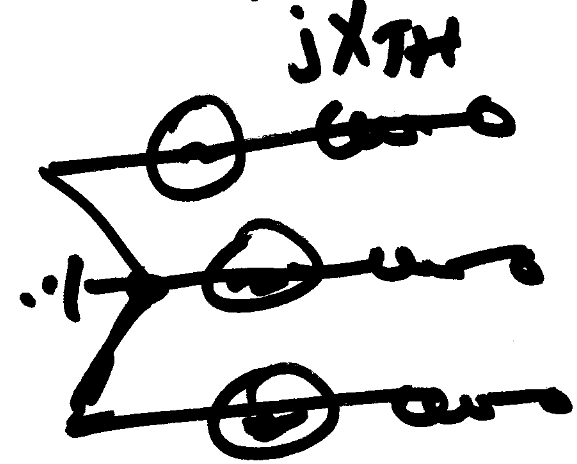
S.C. MVA = 600 (Prob. 4.2)
@ 115-KV Bus



$I_F = \frac{600 \times 10^6}{\sqrt{3}(115,000)} =$



$X_{TH} = \frac{V_{TH}}{I_F}$



Ex: Section 4.12

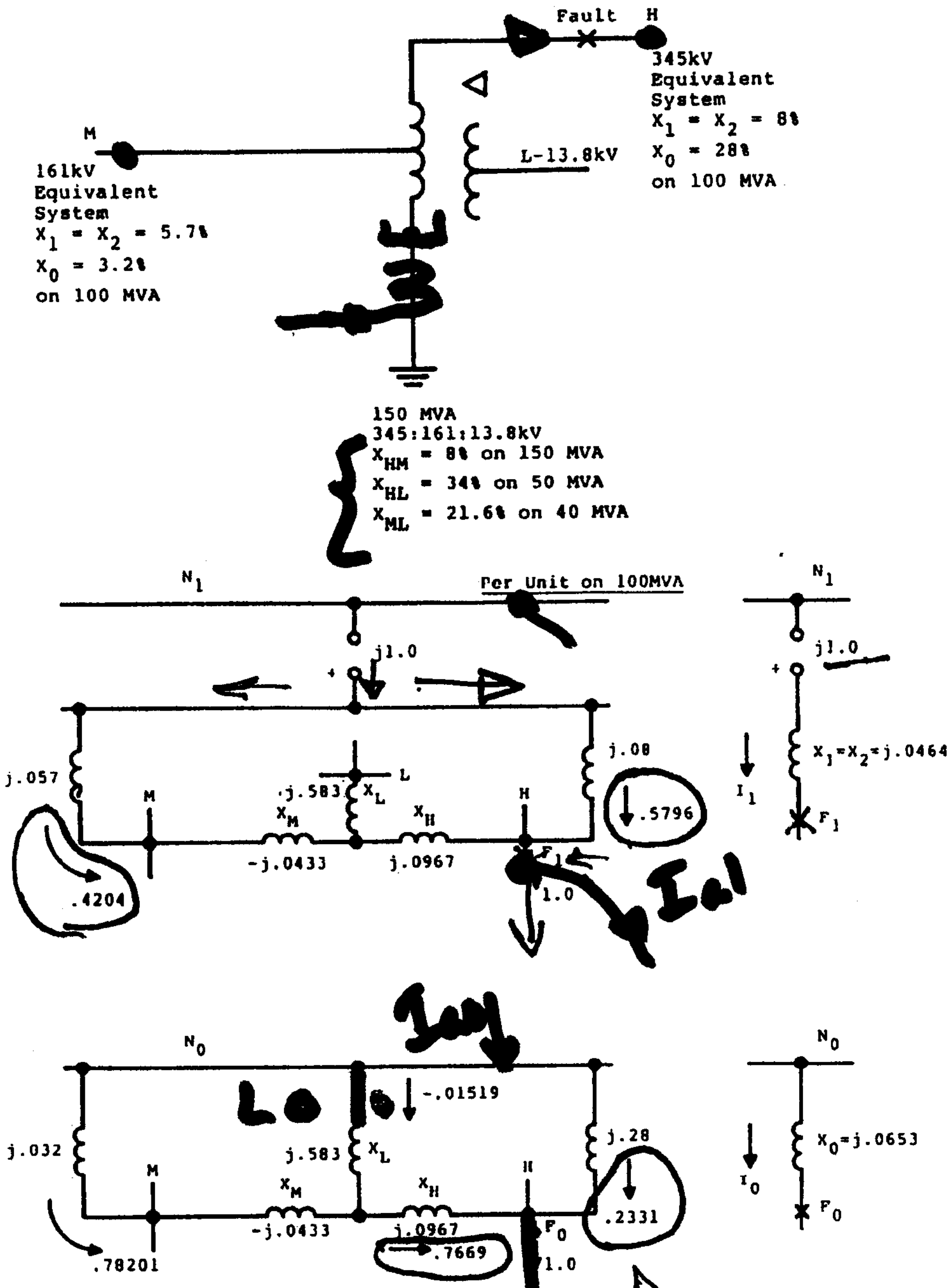
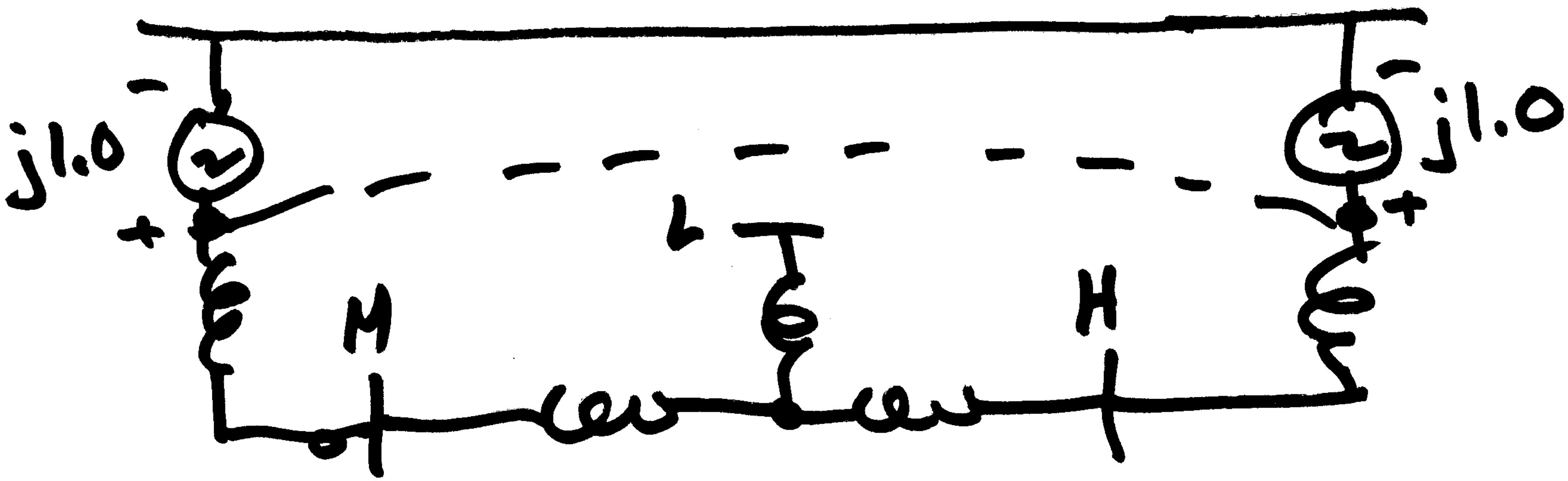
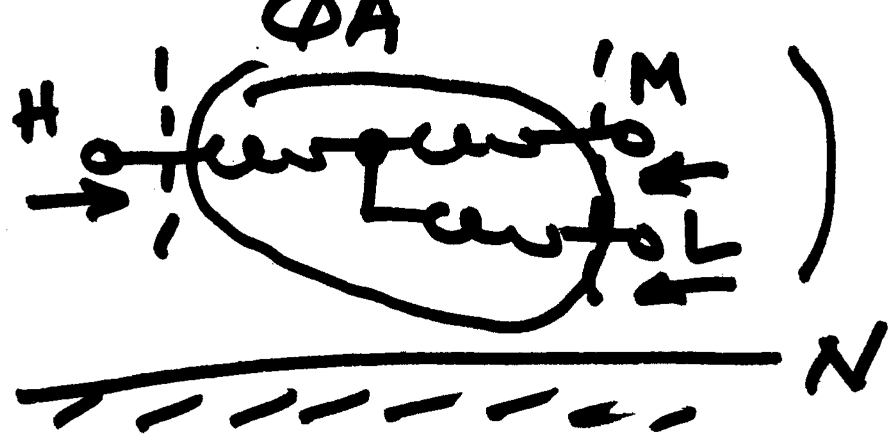


FIGURE 4.20 Example of fault calculation for an autotransformer.

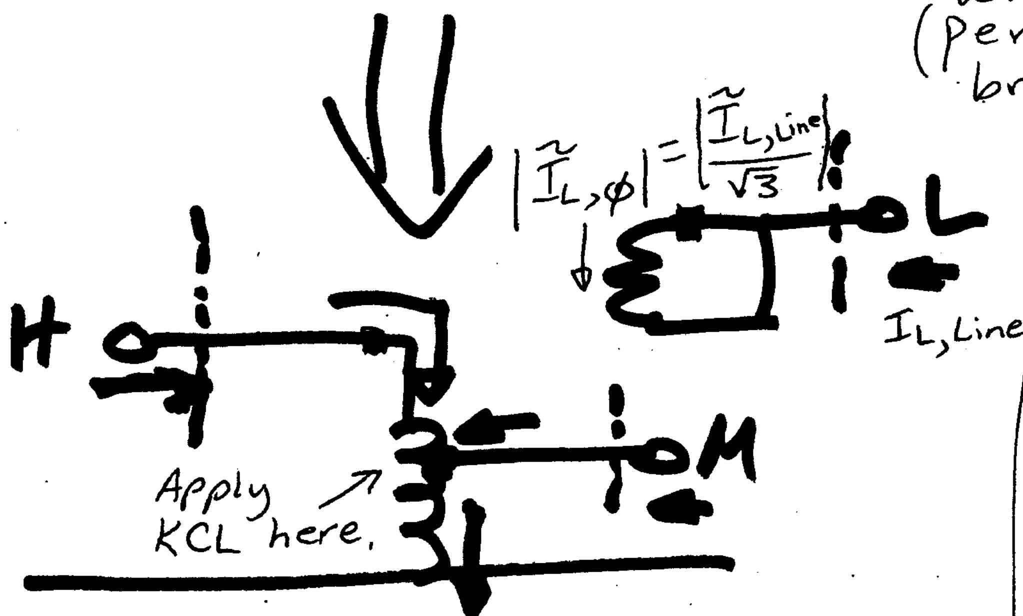
Ĩa0

Current Distribution Factors

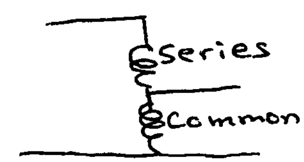

j1.0
j1.0
L
M
H
+
+
-
-



Mathematical model is ok to calculate the currents flowing thru the transformer bushings, but breaks down for determining actual winding currents in xfmr. (per unit system also breaks down).



Instead, convert the per unit current into actual amps flowing into the bushings. Then, trace thru the series, common, and delta windings.



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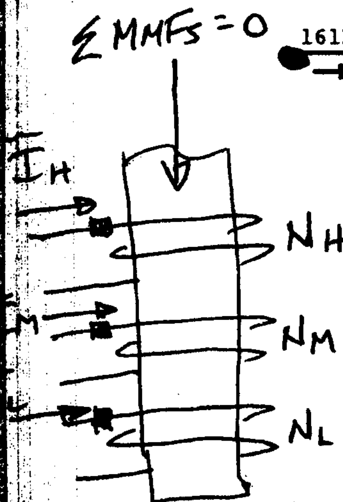
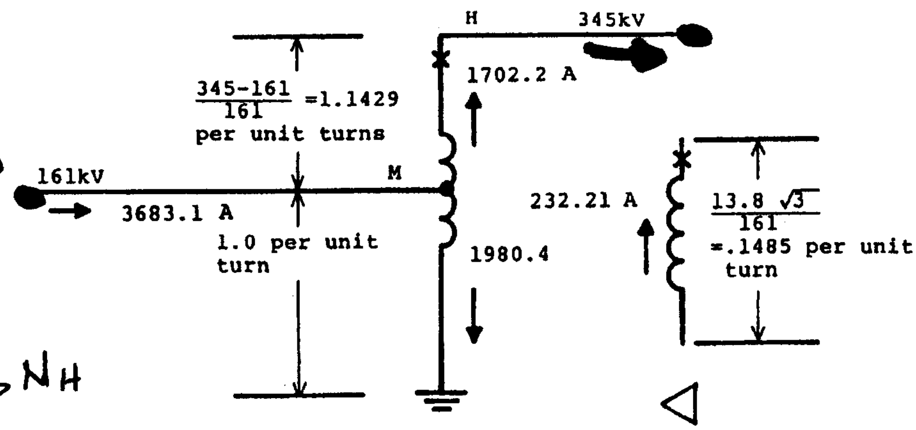




Ampere-turns Up = Ampere-turns Down

1702.7x1.1429 + 232.21x .1485 = 1980.4x1.0

1946.02 + 34.48 = 1980.4

1980.5 = 1980.4 Check.

FIGURE 4.22 Ampere-turn check to confirm or establish the direction of current flow in the tertiary.

$\tilde{I}_H N_H + \tilde{I}_M N_M + \tilde{I}_L N_L = 0$

Also, recall that coil voltages are proportional to N's.

There can be a question about the direction of current in the tertiary. This can be checked by ampere-turns, as shown in Fig. 4.22. Arbitrarily, one per unit turn was assumed for the 161-kV winding, and the others were derived. Any winding or group could be used for the base, as convenient.

i.e. N's are normalized to N_M

4.13 EXAMPLE: OPEN-PHASE CONDUCTOR

A blown fuse or broken conductor that opens one of the three phases represents a series unbalance covered in more detail in Blackburn (1993). As

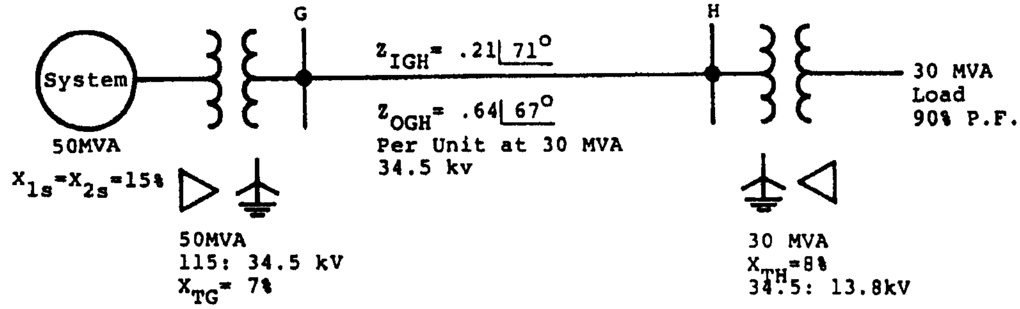
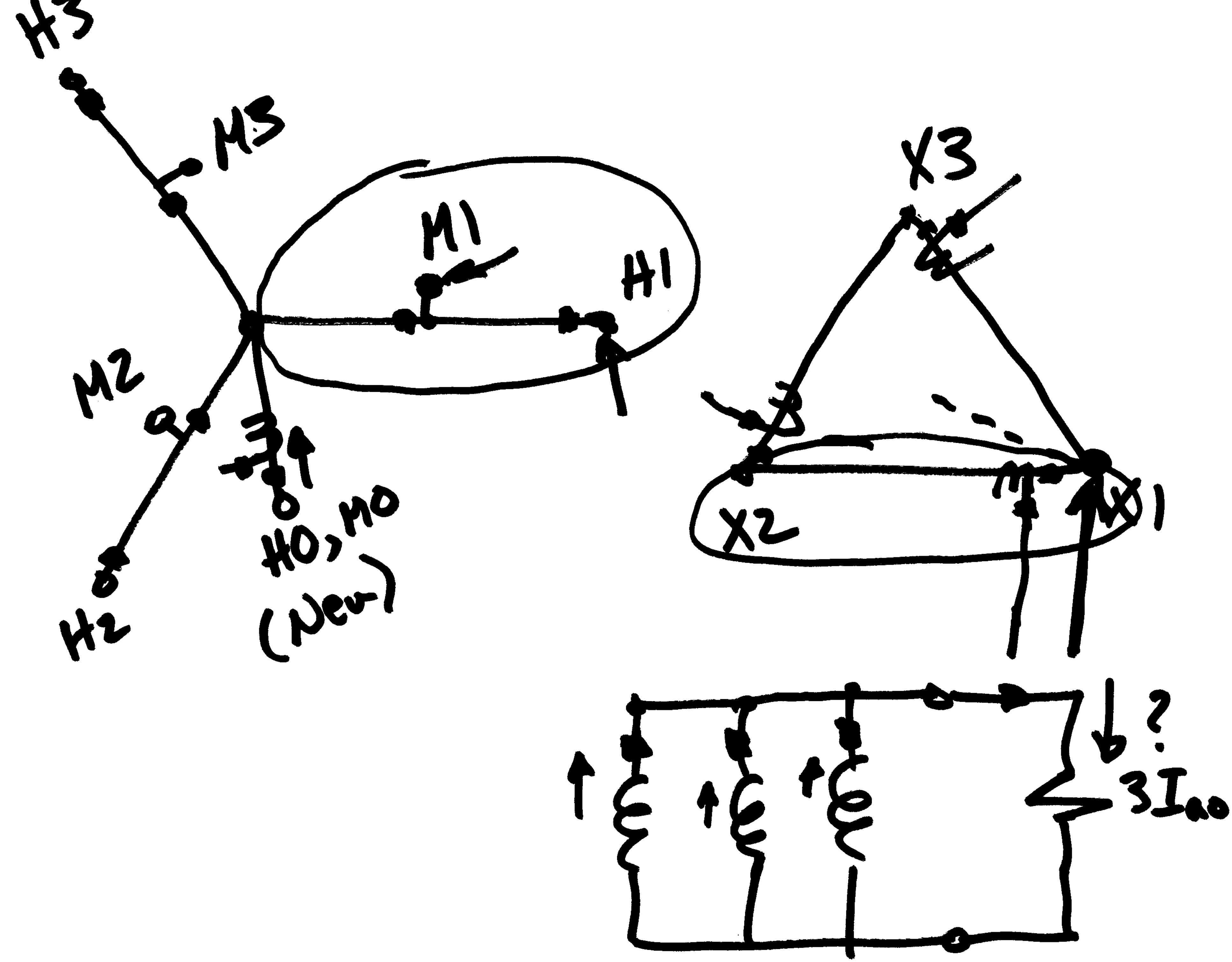
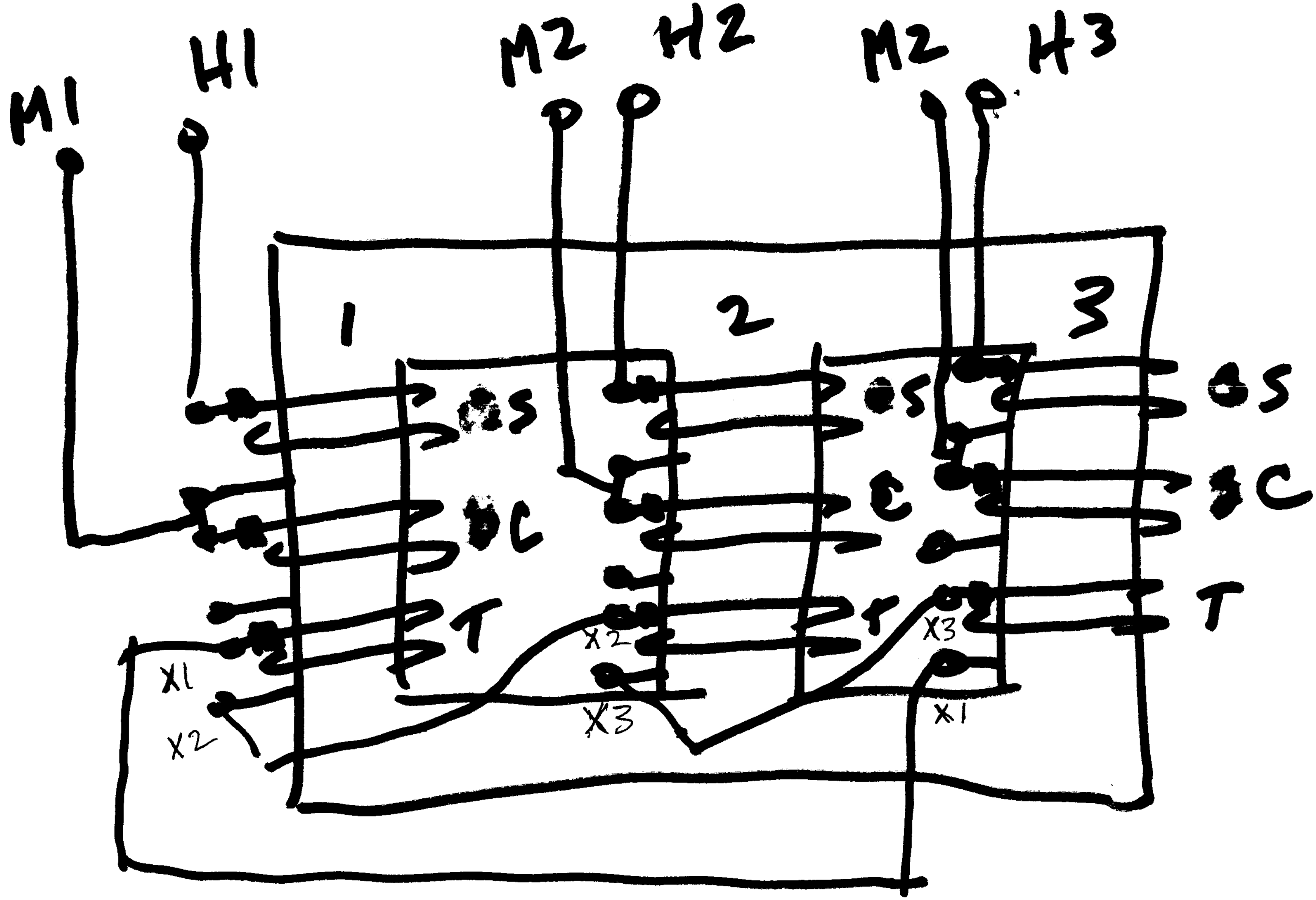
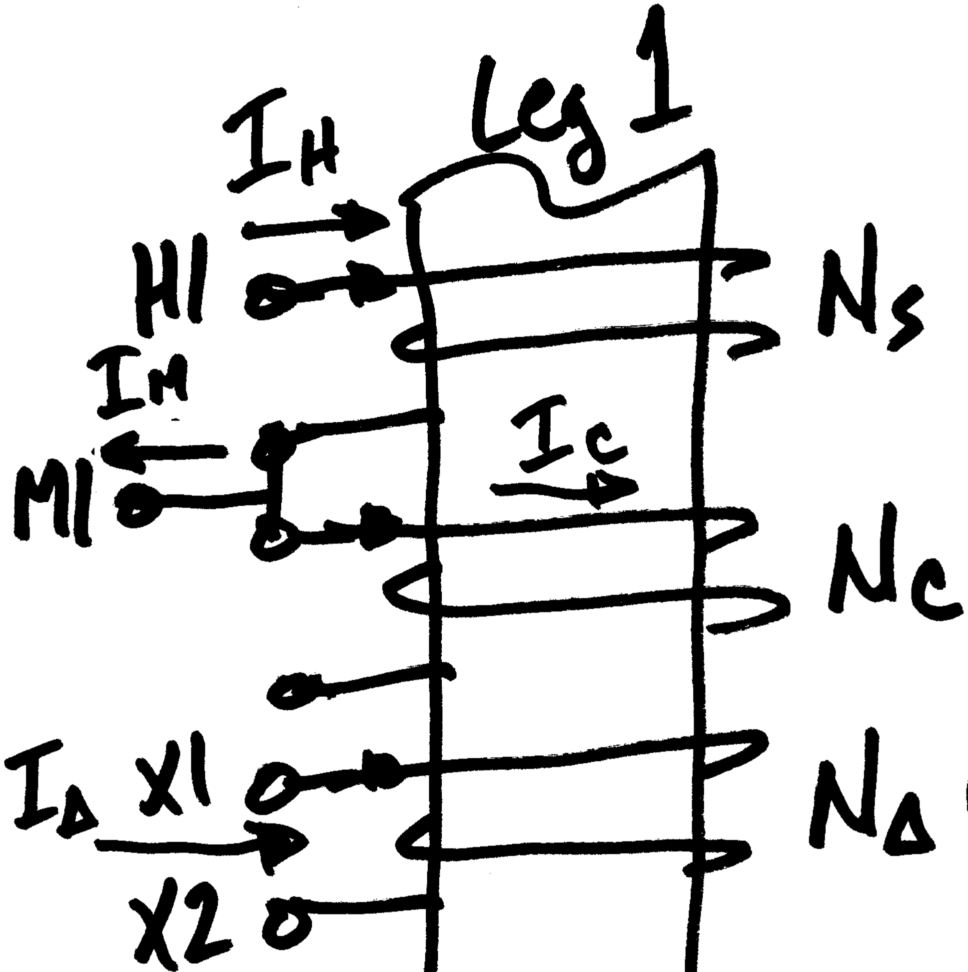


FIGURE 4.23 Example for series unbalance calculations.


H3
M3
M1
H1
M2
H2
H0, M0
(New)
X3
X2
X1
?
$3I_{a0}$


M1
H1
M2
H2
M2
H3
1
2
3
S
C
T
X1
X2
X3

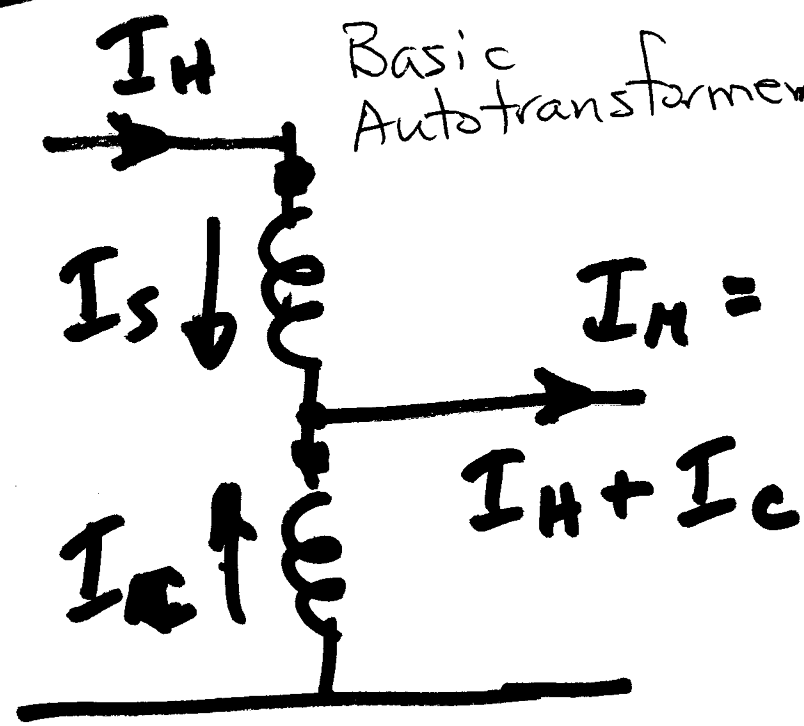


$$I_\Delta = \frac{I_Y}{\sqrt{3}}$$

Choosing reference direction of all winding currents to be <u>into</u> polarity mark...

$$\Sigma \text{ MMFs} = 0$$

$$I_H \underline{N_S} + (I_H - I_M)\underline{\underline{N_C}} + \underline{\underline{I_\Delta}}\, \underline{\underline{N_\Delta}} = 0$$



Ex: Section 4.12

Superposition :

- Linear System
- Total effect as sum of separate effects, i.e. modal analysis like 0,1,2 Components.
- Therefore, we can separately consider the effects of zero sequence currents, tracing them through the xfmr windings.

Goal: What currents are flowing thru neutral and thru the phase-CTs of the delta? Must have correct phase angle and polarity!

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