$$P_{gf} = 2I^2_{mf} R_f \qquad \text{.... (17—33)}$$

Similarly, the total power P_{gb} delivered to the backward field is

$$P_{gb} = 2I^2_{mb} R_b \qquad \text{.... (17—34)}$$

Internal Starting torque

$$T_s = 2(I^2_{mf} - I^2_{mb}) R/w_s \qquad \text{.... (17—35)}$$

Figure 17-6. Phasor diagram of currents and their symmetrical components.

From Figure 17-6,

$$(ob)^2 = (oa)^2 + (ab)^2 - 2(oa)(ab)\cos\angle oab \qquad \text{.... (17—36)}$$

or, in terms of the effective values of the currents,

$$I^2_{mf} = (0.5I_m)^2 + (0.5aI_a)^2 + 2(0.5I_m)(0.5aI_a)\sin\alpha \qquad \text{.... (17—37)}$$

Similarly, for triangle oac

$$I^2_{mb} = (0.5I_m)^2 + (0.5aI_a)^2 - 2(0.5I_m)(0.5aI_a)\sin\alpha \qquad \text{.... (17—38)}$$

Substitution of the difference between Equations 17-37 and 17-38 in Equation 17-35 then gives

$$T_s = 2I_m aI_a R\sin\alpha/w_s \qquad \text{.... (17—39)}$$

Capacitor and split-phase motors are the special case in which

$$V_m = V_a = V \qquad \text{.... (17—40)}$$

where V is the single-phase line voltage. Equations 17-21 and 17-22 then reduce to