Test Odasında Mesafe Koruması Gerilim ve Akım Hesaplamaları

Kategory	**tester**
Bölüm	**AMT Mesafe Modülü**
Dil	**Türkçe**
Oluşturuldu	**2026-11-04**

$$V = Z I_{test}$$

Şekil 1

Single phase fault	$Z_{L\,max} = V_{max} / \sqrt{3}.\lvert 1+K_L \rvert . I_{test}$
Two phase fault	$Z_{L\,max} = V_{max} / 2.I_{test}$
Three phase fault	$Z_{L\,max} = V_{max} / \sqrt{3}.I_{test}$

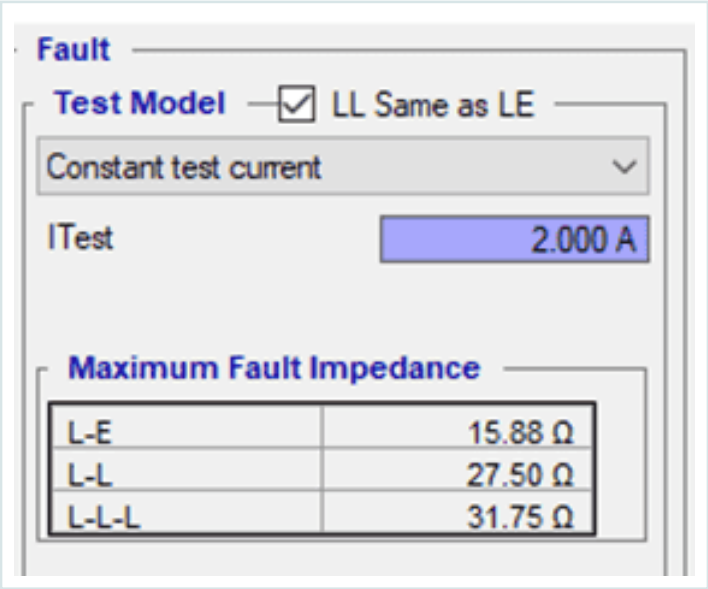
Şekil 2

$$I = \frac{V_{test}}{Z}$$

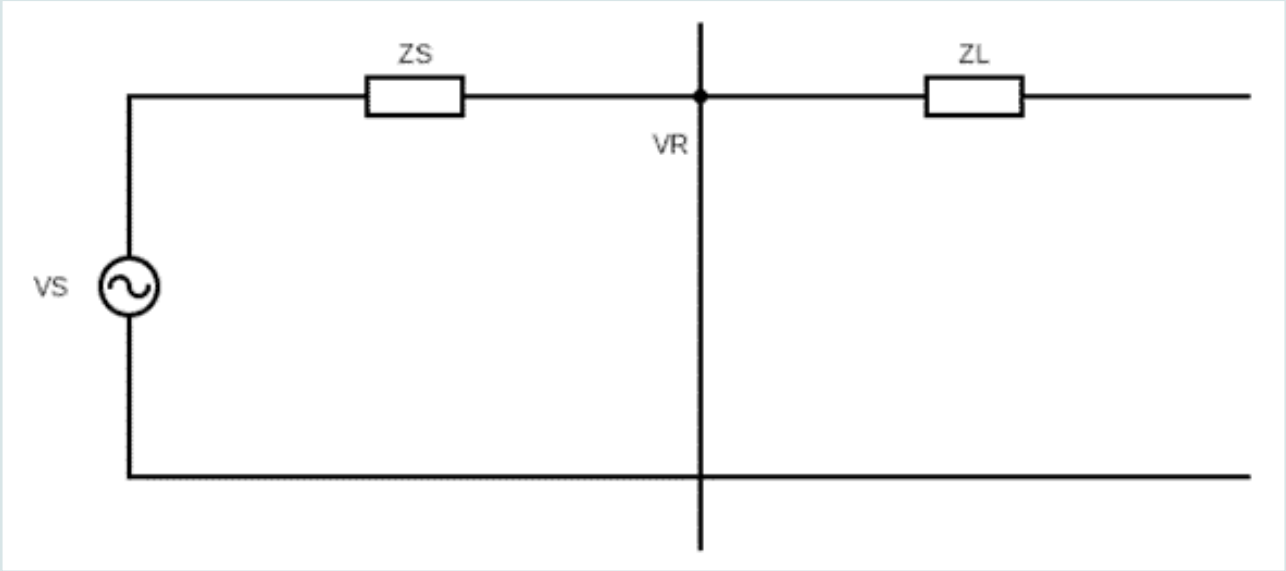
Şekil 3

Single phase faults	$Z_{L\,min} = V_{test} / \lvert 1+K_L \rvert . I_{max}$
Two phase faults	$Z_{L\,min} = V_{test} / 2.\ I_{max}$
Three phase faults	$Z_{L\,min} = V_{test} / I_{max}$

Şekil 4



Şekil 5



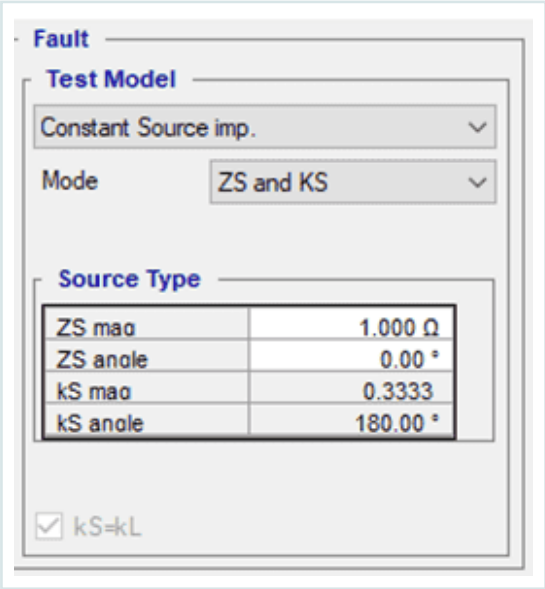
Şekil 6

$$V_R = \frac{Z_L}{Z_L + Z_S} V_S \xrightarrow{Factor:Z_L} V_R = \frac{Z_L}{Z_L(1+\frac{Z_S}{Z_L})} V_S \Rightarrow V_R = \frac{1}{1+\frac{Z_S}{Z_L}} V_S$$

Şekil 7

$$SIR = \frac{Z_S}{Z_L} \Rightarrow V_R = \frac{V_S}{1+SIR}$$

Şekil 8

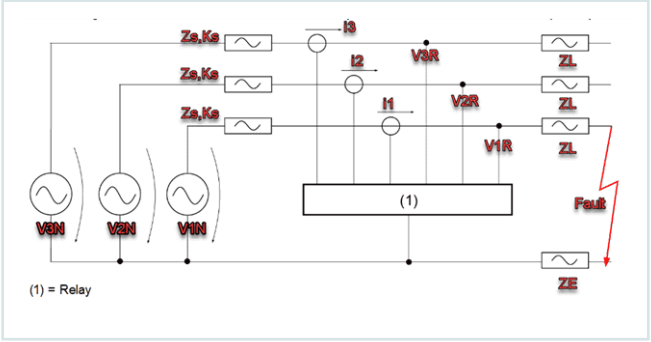


Şekil 9

Z_S and K_S	امپدانس منبع Z_S ضریب زمین K_S
Z_{S1} and Z_{S0}	امپدانس توالی مثبت Z_{S1} امپدانس توالی صفر Z_{S0}
R_S, X_S R_{SE}/R_S, X_{SE}/X_S	قسمت حقیقی و موهومی امپدانس منبع X_S , R_S ضریب زمین به صورت نسبت قسمت حقیقی و نسبت قسمت موهومی R_{SE}/R_S, X_{SE}/X_S
SIR and K_S	نسبت امپدانس منبع به امپدانس بار SIR ضریب زمین : K_S
SSC and X/R	توان ظاهری اتصال کوتاه سه‌فاز تکفاز S_{SC} نسبت بخش موهومی خط به قسمت حقیقی : X/R
ISC and X/R	جریان اتصال کوتاه در حالت سه‌فاز و تکفاز I_{SC} نسبت بخش موهومی امپدانس خط به قسمت حقیقی X/R

$Z_{S1} = Z_S$
$K_S = (Z_{S0} / Z_S - 1) / 3$
$Z_S = R_S + j\ X_S$
$K_S * Z_S = R_E + j\ X_E = R_{SE}/R_S * Rs + j\ X_{SE}/X_S * X_S$
SIR = $\lvert Z_S \rvert$ / $\lvert Z_L \rvert$, Z_L line length in Ohms set on Test object's "System Settings" Tab
$S_{SC\ L\text{-}L\text{-}L} = V_{nom\ L\text{-}L}\ \hat{}\ 2\ /\lvert Z_S \rvert$
$S_{SC\ L\text{-}N} = V_{nom\ L\text{-}N}\ \hat{}\ 2\ /\lvert Z_S * (1 + K_S) \rvert$
$X/R_{L\text{-}L\text{-}L} = \tan(\mathrm{Im}\{Z_S\}\ /\ \mathrm{Re}\{Z_S\})$
$X/R_{L\text{-}N} = \tan(\mathrm{Im}\{Z_S * (1 + K_S)\}\ /\ \mathrm{Re}\{Z_S * (1 + K_S)\})$
$I_{SC\ L\text{-}L\text{-}L} = V_{nom\ L\text{-}N} / \lvert Z_S \rvert$
$I_{SC\ L\text{-}N} = V_{nom\ L\text{-}N} / \lvert Z_S * (1 + K_S) \rvert$

Şekil 10



Şekil 11

$$\begin{bmatrix} i_1 \\ i_2 \\ i_3 \end{bmatrix} = \begin{bmatrix} I_{test} \angle \varphi_{(V_{1N})} - \varphi_{(1+K_L)Z_L)} \\ 0 \\ 0 \end{bmatrix} \quad , \quad \begin{bmatrix} V_{1R} \\ V_{2R} \\ V_{3R} \end{bmatrix} = \begin{bmatrix} I_{test} . \left|(1+K_L).Z_L\right| \angle \varphi_{V_{1N}} \\ V_{2N} \\ V_{3N} \end{bmatrix}$$

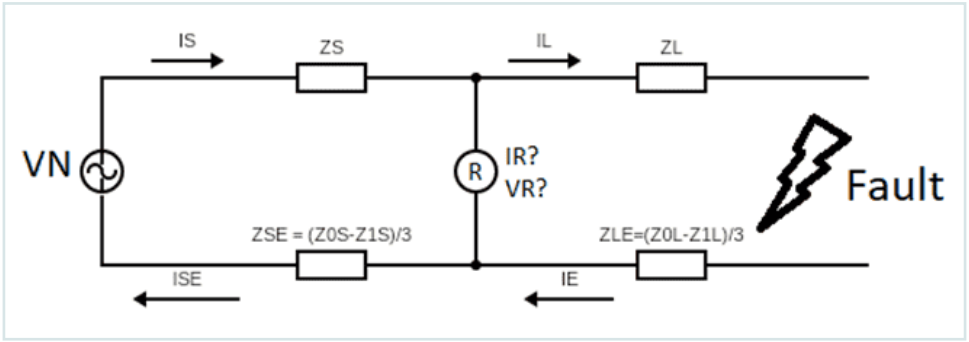
Şekil 12

$$\begin{bmatrix} V_{1R} \\ V_{2R} \\ V_{3R} \end{bmatrix} = \begin{bmatrix} V_{test} \angle \varphi_{V_{1N}} \\ V_{2N} \\ V_{3N} \end{bmatrix} \quad , \quad \begin{bmatrix} i_1 \\ i_2 \\ i_3 \end{bmatrix} = \begin{bmatrix} \left|\frac{V_{1R}}{(1+K_L).Z_L}\right| \angle \varphi_{V_{1N}} - \varphi_{(1+K_L).Z_L} \\ 0 \\ 0 \end{bmatrix}$$

Şekil 13

$$\begin{bmatrix} i_1 \\ i_2 \\ i_3 \end{bmatrix} = \begin{bmatrix} \frac{V_{1N}}{(1+K_S)Z_S + (1+K_L)Z_{test}} \\ 0 \\ 0 \end{bmatrix} \quad , \quad \begin{bmatrix} V_{1R} \\ V_{2R} \\ V_{3R} \end{bmatrix} = \begin{bmatrix} i_1 \ (1+K_L)Z_{test} \\ V_{2N} - i_1 \ K_S Z_S \\ V_{3N} - i_1 \ K_S Z_S \end{bmatrix}$$

Şekil 14



Şekil 15

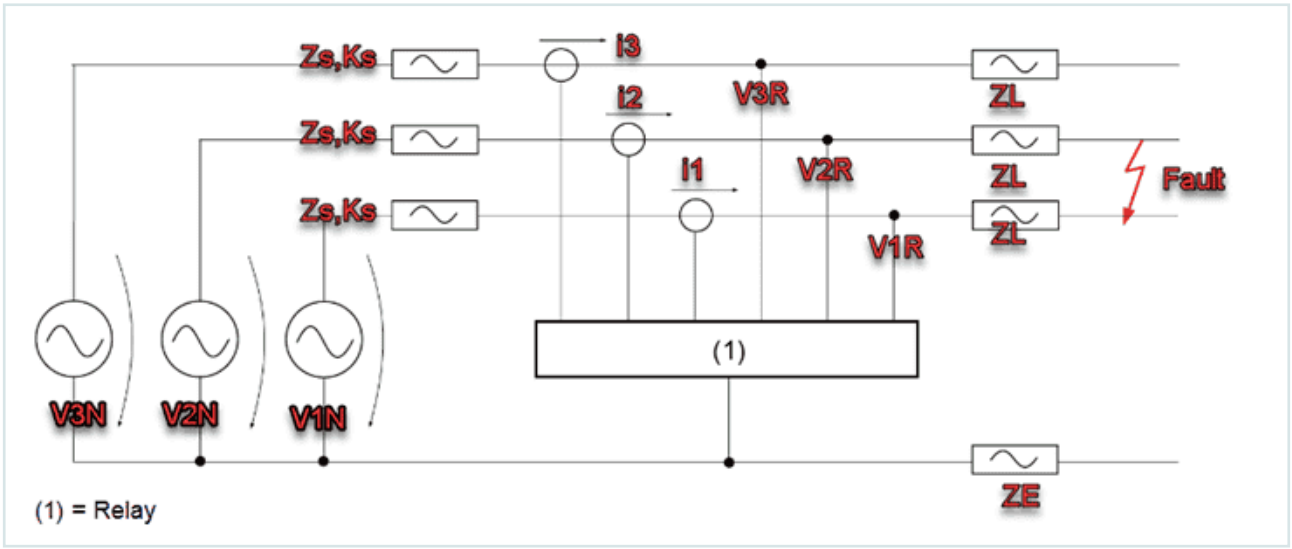
$$V_N = Z_S I_S + Z_L I_L - Z_{LE} I_E - Z_{SE} I_E \xrightarrow{I=I_L=I_S=-I_E} V_N = I(\overbrace{Z_S + Z_L + Z_{LE} + Z_{SE}}^{Z_{Total}})$$

$$\Rightarrow \frac{V_N}{I} = Z_{Total} \xrightarrow{factor:Z_S,Z_L} \frac{V_N}{I} = Z_S(1+\underbrace{\frac{Z_{SE}}{Z_S}}_{K_S}) + Z_L(1+\underbrace{\frac{Z_E}{Z_L}}_{K_L})$$

$$\Rightarrow I_1 = \frac{Z_S(1+K_S) + Z_L(1+K_L)}{V_N} \;,\; I_2 = 0 \;,\; I_3 = 0$$

$$V_{1R} = I_1.Z_L.(1+K_L) \quad , \quad V_{2R} = V_{2N} - I_1.K_S.Z_S \quad , \quad V_{3R} = V_{3N} - I_1.K_S.Z_S$$

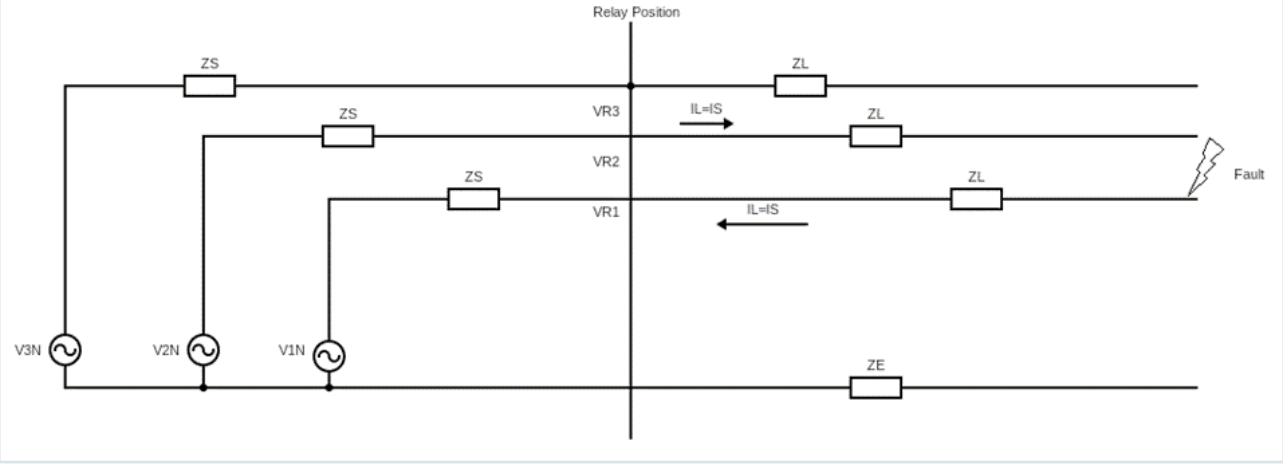
Şekil 16



Şekil 17

$$\begin{bmatrix} i_1 \\ i_2 \\ i_3 \end{bmatrix} = \begin{bmatrix} I_{test} \angle \varphi_{(V_{1N}-V_{2N})} - \varphi_{Z_{test}} \\ i_1 * 1 \angle 180^\circ \\ 0 \end{bmatrix} \quad , \quad \begin{bmatrix} V_{1R} \\ V_{2R} \\ V_{3R} \end{bmatrix} = \begin{bmatrix} Z_{test} i_1 - \frac{V_{3N}}{2} \\ Z_{test} i_2 - \frac{V_{3N}}{2} \\ V_{3N} \end{bmatrix}$$

Şekil 18



Şekil 19

$$\begin{cases} V_{1N} = Z_S I_S + V_{R1N} \\ V_{2N} = -Z_S I_S + V_{R2N} \\ V_{3N} = V_{R3N} \end{cases} \xrightarrow{SUM} V_{R1N} + V_{R2N} + V_{R3N} = 0$$

$$\xrightarrow{Also} V_{R1N} - V_{R2N} = 2Z_L I_L \boxed{1} \xrightarrow{Sum} 2V_{R1N} + V_{R3N} = 2Z_L I_L$$

$$\Rightarrow V_{R1N} = Z_L I_L - \frac{V_{R3N}}{2} \boxed{2}$$

$$\boxed{1} \Rightarrow V_{R2N} = V_{R1N} - 2Z_L I_L \xrightarrow{1,2} V_{R2N} = Z_L I_L - \frac{V_{R3N}}{2} - 2Z_L I_L$$

$$\Rightarrow V_{R2N} = \overset{Negative}{-Z_L} \; I_L - \frac{V_{R3N}}{2} \Rightarrow V_{R2N} = Z_L I_L - \frac{V_{R3N}}{2}$$

Şekil 20

$$\begin{bmatrix} i_1 \\ i_2 \\ i_3 \end{bmatrix} = \begin{bmatrix} \dfrac{V_{test}}{2.\left|Z_{test}\right|} \angle \varphi_{(V_{1N}-V_{2N})} - \varphi_{Z_{test}} \\ i_1 * 1 \angle 180^\circ \\ 0 \end{bmatrix} , \quad \begin{bmatrix} V_{1R} \\ V_{2R} \\ V_{3R} \end{bmatrix} = \begin{bmatrix} Z_{test} i_1 - \dfrac{V_{3N}}{2} \\ Z_{test} i_2 - \dfrac{V_{3N}}{2} \\ V_{3N} \end{bmatrix}$$

Şekil 21

Pr $eFault$:

$V_{L1\text{-}L2} = 110\angle 0$, $V_{L1\text{-}E} = 63.51\angle -30$, $I_{L1} = I_{load}\angle 0$

$V_{L2\text{-}L3} = 110\angle -120$, $V_{L2\text{-}E} = 63.51\angle -150$, $I_{L2} = I_{load}\angle -120$

$V_{L3\text{-}L1} = 110\angle 120$, $V_{L3\text{-}E} = 63.51\angle 90$, $I_{L2} = I_{load}\angle 120$

Fault(L1-L2):

$V_{L1\text{-}L2} = V_{test}\angle 0$

$V_{L3\text{-}E} = 63.51\angle 90$

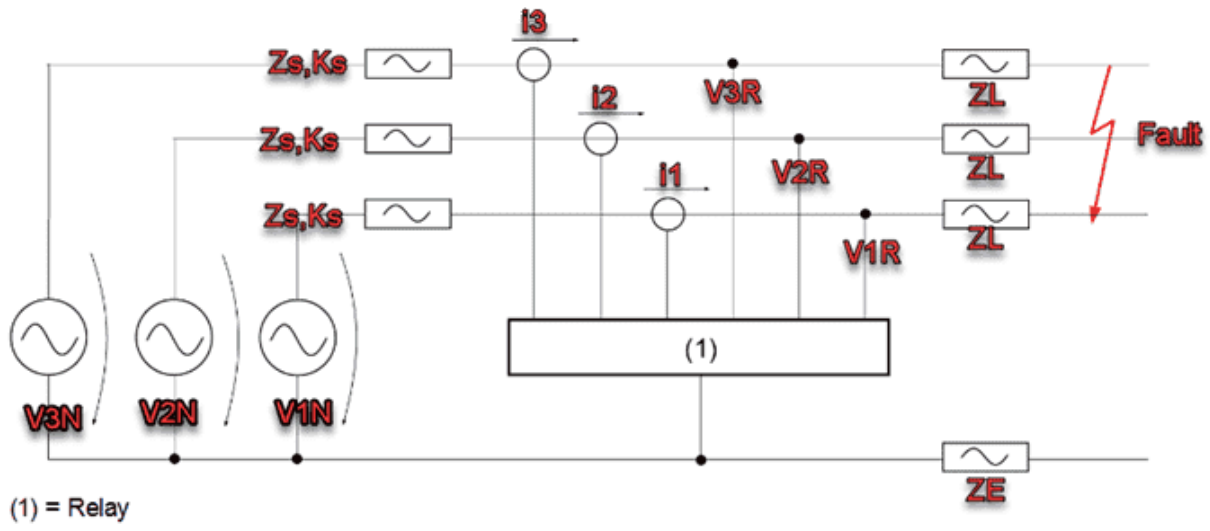
$\rightarrow V_{L1\text{-}E} - V_{L2\text{-}E} = V_{test}\angle 0 \xrightarrow[If\ Vtest=50]{Sum} 2 * V_{L1\text{-}E} = 50\angle 0 - 63.51\angle 90 \rightarrow V_{L1\text{-}E} = 40.41\angle -51.79$, $V_{L2\text{-}E} = 40.41\angle -128.21$

$\rightarrow V_{L1\text{-}E} + V_{L2\text{-}E} = -V_{L3\text{-}E}$

Şekil 22

$$\begin{bmatrix} i_1 \\ i_2 \\ i_3 \end{bmatrix} = \begin{bmatrix} \dfrac{V_{1N} - V_{2N}}{2(Z_S + Z_{test})} \\ -i_1 \\ 0 \end{bmatrix} , \quad \begin{bmatrix} V_{1R} \\ V_{2R} \\ V_{3R} \end{bmatrix} = \begin{bmatrix} V_{1N} - i_1 Z_S \\ V_{2N} + i_1 Z_S \\ V_{3N} \end{bmatrix}$$

Şekil 23



Şekil 24

$$\begin{bmatrix} i_1 \\ i_2 \\ i_3 \end{bmatrix} = \begin{bmatrix} I_{test}\angle\varphi_{V_{1N}} - \varphi_{Z_L} \\ I_{test}\angle\varphi_{V_{2N}} - \varphi_{Z_L} \\ I_{test}\angle\varphi_{V_{3N}} - \varphi_{Z_L} \end{bmatrix} \quad , \quad \begin{bmatrix} V_{1R} \\ V_{2R} \\ V_{3R} \end{bmatrix} = \begin{bmatrix} I_{test} \cdot |Z_L| \angle\varphi_{V_{1N}} \\ I_{test} \cdot |Z_L| \angle\varphi_{V_{2N}} \\ I_{test} \cdot |Z_L| \angle\varphi_{V_{3N}} \end{bmatrix}$$

Şekil 25

$$\begin{bmatrix} V_{1R} \\ V_{2R} \\ V_{3R} \end{bmatrix} = \begin{bmatrix} V_{test}\angle\varphi_{V_{1N}} \\ V_{test}\angle\varphi_{V_{2N}} \\ V_{test}\angle\varphi_{V_{3N}} \end{bmatrix} \quad , \quad \begin{bmatrix} i_1 \\ i_2 \\ i_3 \end{bmatrix} = \begin{bmatrix} \frac{V_{test}}{|Z_L|}\angle\varphi_{V_{1N}} - \varphi_{Z_L} \\ \frac{V_{test}}{|Z_L|}\angle\varphi_{V_{2N}} - \varphi_{Z_L} \\ \frac{V_{test}}{|Z_L|}\angle\varphi_{V_{3N}} - \varphi_{Z_L} \end{bmatrix}$$

Şekil 26

$$\begin{bmatrix} i_1 \\ i_2 \\ i_3 \end{bmatrix} = \begin{bmatrix} \frac{V_{1N}}{Z_S + Z_{test}} \\ \frac{V_{2N}}{Z_S + Z_{test}} \\ \frac{V_{3N}}{Z_S + Z_{test}} \end{bmatrix} \quad , \quad \begin{bmatrix} V_{1R} \\ V_{2R} \\ V_{3R} \end{bmatrix} = \begin{bmatrix} \frac{V_{1N} \cdot Z_{test}}{Z_S + Z_{test}} \\ \frac{V_{2N} \cdot Z_{test}}{Z_S + Z_{test}} \\ \frac{V_{3N} \cdot Z_{test}}{Z_S + Z_{test}} \end{bmatrix}$$

Şekil 27