Symmetrical Components of Three Unbalanced Phasors

Zero-, positive- and negative-sequence components of three unbalanced voltages or currents from their magnitudes and angles, with the unbalance factors.

Method: C.L. Fortescue; Trans. AIEE 37 (1918) 1027 (method of symmetrical coordinates)

Input parameters

Unit system: SI

Parameter	Value	Unit
Phase A magnitude	230.00	V
Phase A angle	0	°
Phase B magnitude	220.00	V
Phase B angle	-120.00	°
Phase C magnitude	240.00	V
Phase C angle	125.00	°

Calculated results

Parameter	Value	Unit
Zero-sequence component	6.2243	V
Positive-sequence component	229.80	V
Negative-sequence component	10.920	V
Negative-sequence unbalance factor	4.7521	%
Zero-sequence unbalance factor	2.7085	%
Zero-sequence angle	161.03	°
Positive-sequence angle	1.7387	°
Negative-sequence angle	-55.467	°

Notes for this case

- The same transform applies to currents: read the voltages as amperes. Angles are those of the phase-A sequence phasors; an angle is not shown when its component is zero.

Formula and method

$$V_0 = \frac{1}{3}(V_a + V_b + V_c), \quad V_1 = \frac{1}{3}(V_a + aV_b + a^2V_c), \quad V_2 = \frac{1}{3}(V_a + a^2V_b + aV_c), \quad a = 1\angle 120°$$

Variables

V_a	Phase A magnitude	V
θ_a	Phase A angle	rad
V_b	Phase B magnitude	V
θ_b	Phase B angle	rad
V_c	Phase C magnitude	V
θ_c	Phase C angle	rad
V_0	Zero-sequence component	V
V_1	Positive-sequence component	V
V_2	Negative-sequence component	V
V_2/V_1	Negative-sequence unbalance factor	-
V_0/V_1	Zero-sequence unbalance factor	-

θ_0	Zero-sequence angle	rad
θ_1	Positive-sequence angle	rad
θ_2	Negative-sequence angle	rad

Method and standards

Fortescue's transformation with complex phasors.

Assumptions and limits

- Sequence phasors are those of phase A; the angles θ_0, θ_1 and θ_2 are their arguments, measured from the same reference as the inputs. A zero component has no angle.
- Phase order a–b–c.

References

- C.L. Fortescue
- Trans. AIEE 37 (1918) 1027 (method of symmetrical coordinates)

Report details

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Results are for engineering estimation. Verify critical designs against the referenced standards and your own data.

This calculator online

https://calc.firecad.com/electrical/protection/symmetrical-components

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.