

# Per unit representation of power system





## Overview

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The impedance diagram on single-phase basis for use under balanced conditions can be easily drawn from the SLD. The.

The single phase transformer equivalents are shown as ideals with impedances on appropriate side (LV/HV), The magnetizing reactances of transformers are negligible, The generators are represented as constant voltage.

With some more additional and simplifying assumptions, the impedance diagram can be simplified further to obtain the corresponding reactance diagram. The following are the assumptions made.

The resistance is often omitted during the fault analysis. This causes a very negligible error since, resistances are negligible Loads are Omitted Transmission line capacitances are ineffective & Magnetizing currents of transf.

during the power system analysis, it is a usual practice to represent current, voltage, impedance, power, etc., of an electric power system in per unit or percentage of the base or reference value of the respective quanti.

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The resistance is often omitted during the fault analysis. This causes a very negligible error since, resistances are negligible Loads are Omitted Transmission line capacitances are ineffective & Magnetizing currents of transformers are neglected.

There are several reasons for using a per-unit system: • Similar apparatus (generators, transformers, lines) will have similar per-unit impedances and losses expressed on their own rating, regardless of their absolute size.



Because of this, per-unit data can be checked rapidly for gross errors. A per unit value out of normal range is worth looking into for potential errors.

To alleviate this problem, all the system quantities are converted into a uniform normalized platform. This is called the per unit system. In a per unit system each system variable or quantity is normalized with respect to its own base value. The units of these normalized values are per unit (abbreviated as pu) and not Volt, Ampere or Ohm. What is a per unit data representation?

Per unit data representation yields important information about relative magnitudes. The per-unit system was developed to make manual analysis of power systems easier. Although power-system analysis is now done by computer, results are often expressed as per-unit values on a convenient system-wide base.

What is a per unit system?

Conversion of per-unit quantities to volts, ohms, or amperes requires a knowledge of the base that the per-unit quantities were referenced to. The per-unit system is used in power flow, short circuit evaluation, motor starting studies etc. The main idea of a per unit system is to absorb large differences in absolute values into base relationships.

What is a per unit value in a power system?

The per unit value of any quantity is defined as: The Per Unit System in Power System is convenient on various sections of a power system are connected through transformers and have different voltage levels. Consider first a single-phase system. Let Then If the actual impedance is  $Z$  (ohms), its per unit value is given by.

What is a per-unit system in Electrical Engineering?

In the power systems analysis field of electrical engineering, a per-unit system is the expression of system quantities as fractions of a defined base unit quantity. Calculations are simplified because quantities expressed as per-unit do not change when they are referred from one side of a transformer to the other.

How to set up a per-unit system of notation?



The basis for the per-unit system of notation is the expression of voltage and current as fractions of base levels. Thus the first step in setting up a per-unit normalization is to pick base voltage and current. Consider the simple situation shown in Figure 22. For this network, the complex amplitudes of voltage and current are:  $V_{\perp} = IZ_{\perp}$ .

What is an example of a per-unit power transmission system?

As an example of how per-unit is used, consider a three-phase power transmission system that deals with powers of the order of 500 MW and uses a nominal voltage of 138 kV for transmission. We arbitrarily select , and use the nominal voltage 138 kV as the base voltage .



## Per unit representation of power system

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### [3.7: Introduction To Per-Unit Systems](#)



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### [Per-Unit Quantities In Power System Analysis](#)

- oWith per-unit quantities, all voltage magnitudes would be close to 1.0 for normal operation.
- oGoing from per-unit quantities to actual quantities, or vice versa, is just a rescaling operation. ...



### [FUNDAMENTALS OF POWER SYSTEM MODELING](#)

POWER SYSTEM MODELING 1 FORTUNATO C. LEYNES MBA, PEE, IIEE Fellow, APEC Engineer ASEAN Chartered Prof. Engineer o PER-UNIT REPRESENTATION YIELDS MORE RELEVANT INFORMATION AND EASILY CORRELATED DATA. 21

### [Per Unit System in Power System:](#)

Per Unit System in power system is usual to express voltage, current, voltamperes and impedance of an electrical circuit in per unit (or percentage) of base or reference values of ...



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### "Per unit system" in Electrical Engineering , Explained

Per unit system is generally used in the power system calculations & analysis. It is generally used to calculate short circuit current, power flow, and machi

### A GUI based per-unit representation of power system with ...

This paper presents the GUI based per-unit representation of power systems with symmetrical components in the visual basic (VB) environment. The software allows the user to draw the ...



- IP65/IP55 OUTDOOR CABINET
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### Per Unit Representation

Section VI: Per Unit Representation In a power system different power equipment with different voltage and power levels are connected together through various step up or step down transformers. However the presence of various voltage and power levels causes





## The Per-Unit Method

The per-unit (PU) method is a technique for handling any kind of quantity with its particular dimensions as quantities of a dimensionless ratio value based on 1.0 pu or 100%. Transformers can be handled by PU expressions as equipment in which Kirchhoff's law is



## Per-Unit System of Units

The per-unit system is widely used in the power system industry to express values of voltages, currents, powers, and impedances of various power equipment. It is typically used for transformers and AC machines. For a given quantity (voltage, current, power

## Representation of power system components , PPT

Representation of power system components - Download as a PDF or view online for free 11. A DVA NTA GES OF PER UNIT COMPUTA TIONS  
Manufacturers usually specify the impedance of an apparatus in per unit or per cent value on the base of the name plate rating of the apparatus. The per unit impedance of the same type of machines, may be of different ...



## Per-Unit System

Per-unit representation of signals has many advantages over the SI units. This technique: Improves the computational efficiency of code execution, and therefore is a preferred system for fixed-point targets.

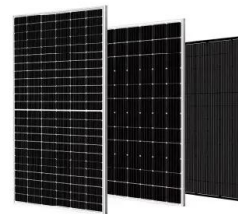






### Per-unit System

Formulas For each system parameter, per-unit value is equal to the actual value divided by a base value:  $E_{pu} = E / E_{base}$   $I_{pu} = I / I_{base}$   $Z_{pu} = Z / Z_{base}$  Select rated values as base values, usually rated power in MVA and rated phase voltage in kV:  $S_{base} = S_{rated} = \sqrt{3}E_{line} I_{...}$



### The Impedance Diagram of Power Systems Explained ...

By using a common base value, the per unit system eliminates the need to convert between different unit systems and simplifies the analysis of complex power systems. Per unit impedance diagrams are commonly used in power ...

### Per Unit System , Advantages of Per Unit System

The Per Unit System While carrying out the analysis of electrical machines (or electrical machine systems), it is usual to express voltage, current, VA and In large devices and systems it is more practical to express the bases in kVA/ MVA and kV. Then Eq. (3.49





[Unit-1 Per Unit System.pptx](#)

3. In the power systems analysis, a per-unit system is the expression of system quantities as fractions of a defined base unit quantity. In a large interconnected power system with various voltage levels and various capacity equipments, it has been found quite convenient to work with per unit (p.u) system of quantities for analysis purpose rather than in absolute values ...



[Per-Unit System for Single-Phase Transformers](#)

The load's per-unit impedance is c) The current flowing in this per-unit power system is The per-unit equivalent circuit, 10 30 5.76 1.736 30 Z load pu pu, 10 0.569 30.6 0.0087 0.026 1.736 30 pu pu tot pu V lpu Zj



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**Per-Unit Quantities and Systems in Power Systems**

Per Unit Quantities & System In PSA calculation of impedances, currents, voltages, and powers are done in p.u values (scaled or normalized) rather than using the physical values of (Omega), A, KV, and KVA Per-unit value of any quantity can be defined as 
$$p.u = \frac{\text{physical value of quantity}}{\text{base value of quantity}}$$

**Power Systems Questions and Answers - Per Unit (PU) System**

This set of Power Systems Multiple Choice Questions & Answers (MCQs) focuses on "Per Unit (PU) System". 1. A power system network is connected as shown in the figure.



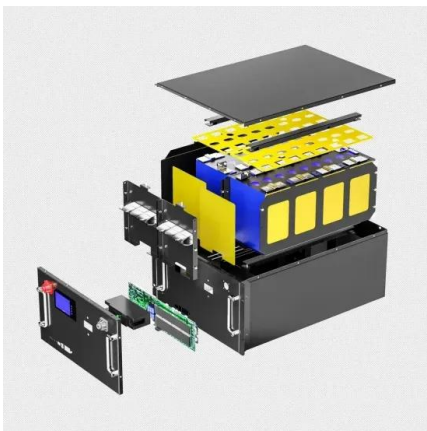


**(PDF) A GUI based per-unit representation of power system with**

This paper presents the GUI based per-unit representation of power systems with symmetrical components in the visual basic (VB) environment. The software allows the user to draw the single line

[Per unit representation , PPT](#)

Per unit representation - Download as a PDF or view online for free 7. Advantages of per unit representation 1. ordinary parameters vary considerably with variation of physical size, terminal voltage and power rating ...

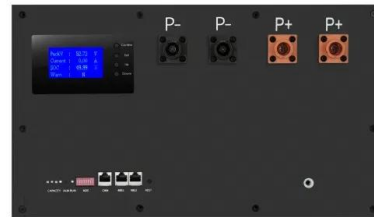


**Representation of Power System (With Diagram) , Electrical Engineering**

Reactance Diagram Representation of a Power System: The impedance diagram can further be simplified by making certain assumptions and reduced to simplified reactance diagram. Reactance diagram is drawn by neglecting effective resistance of generator armature, transformer winding resistance, transmission line resistance, line charging and the magnetizing circuit of ...

[Unit 1 Power System Overview](#)

UNIT I - POWER SYSTEM OVERVIEW (6 hours)  
Power scenario in India, Power system components, Representation. Single line diagram, per unit quantities, p.u. impedance diagram, Network graph, Bus incidence matrix, Primitive parameters, Bus



### A GUI based per-unit representation of power system with ...

Every textbook on power system analysis discusses the per-unit system, varying in depth with problems and solutions. However, it is still not an interactive method for teaching and learning the per-unit representation. Thus, it needs a new approach to make teaching and learning process more interactive and interesting for students. The graphical user interface (GUI) provides the ...

### Introduction to Per Unit Systems in Power Systems Part 1a

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