INTERNATIONAL MULTIDISCIPLINARY JOURNAL FOR RESEARCH & DEVELOPMENT
SJIF 2019: 5.222 2020: 5.552 2021: 5.637 2022:5.479 2023:6.563 2024: 7,805
eISSN :2394-6334 https://www.ijmrd.in/index.php/imjrd Volume 11, issue 12 (2024)

TRANSIENT PROCESSES OF THE ENERGY SYSTEM ANALYSIS AND CREATION OF ITS MODEL IN MATLAB SIMULINK

Zokirova Dilnoza Nematillaevna
Namangan Engineering-Construction Institute

Abstract. The article is devoted to the creation of a model of the power system for modeling and analyzing transient processes of the power system (PS) in emergency mode.
The created model is based on the possibility of rapid recalculation of variable parameters of ES elements in short-circuit mode with the possibility of graphical visualization.
Key words*:* graphic visualization, MATLAB, emergency mode, simulation

Simulink is an interactive tool included in MATLAB for modeling, simulating, and analyzing dynamic systems. It provides the ability to create graphical block diagrams, simulate dynamic systems, test system performance, and improve designs. Simulink provides the ability to model real systems and devices as models composed of functional blocks.
Simulink has a very large set of blocks that represent real objects mathematically and physically. Block parameters are entered and changed using simple tools. In addition, this set of blocks can be further extended by the user, i.e. the user can not only modify existing blocks, but also create new blocks and thus create his own set of blocks.

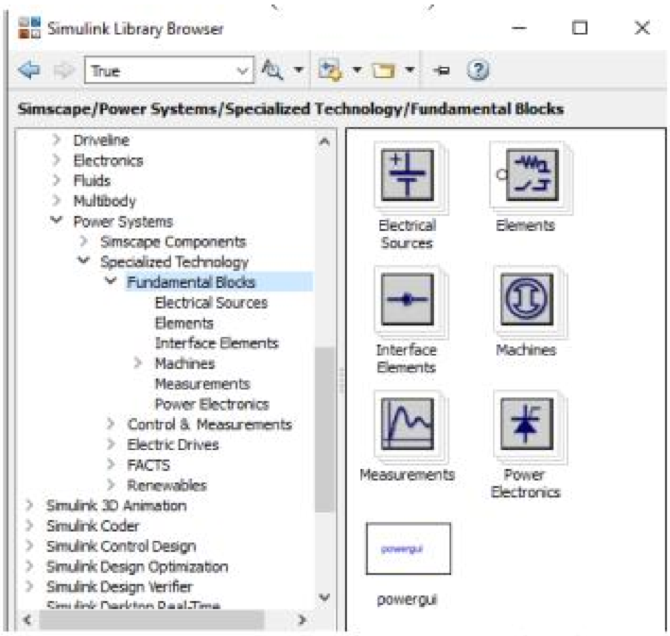

Figure 1. PowerSystems collection.
The fundamental blocks used to solve power problems are located in the Fundamental Blocks section of the Simscape package and can be found by navigating to Simscape → Power Systems → Specialized Technology → Fundamental Blocks (Figure 1).

INTERNATIONAL MULTIDISCIPLINARY JOURNAL FOR RESEARCH & DEVELOPMENT
SJIF 2019: 5.222 2020: 5.552 2021: 5.637 2022:5.479 2023:6.563 2024: 7,805
eISSN :2394-6334 https://www.ijmrd.in/index.php/imjrd Volume 11, issue 12 (2024)

Figure 2 shows the ES model assembled in MATLAB.

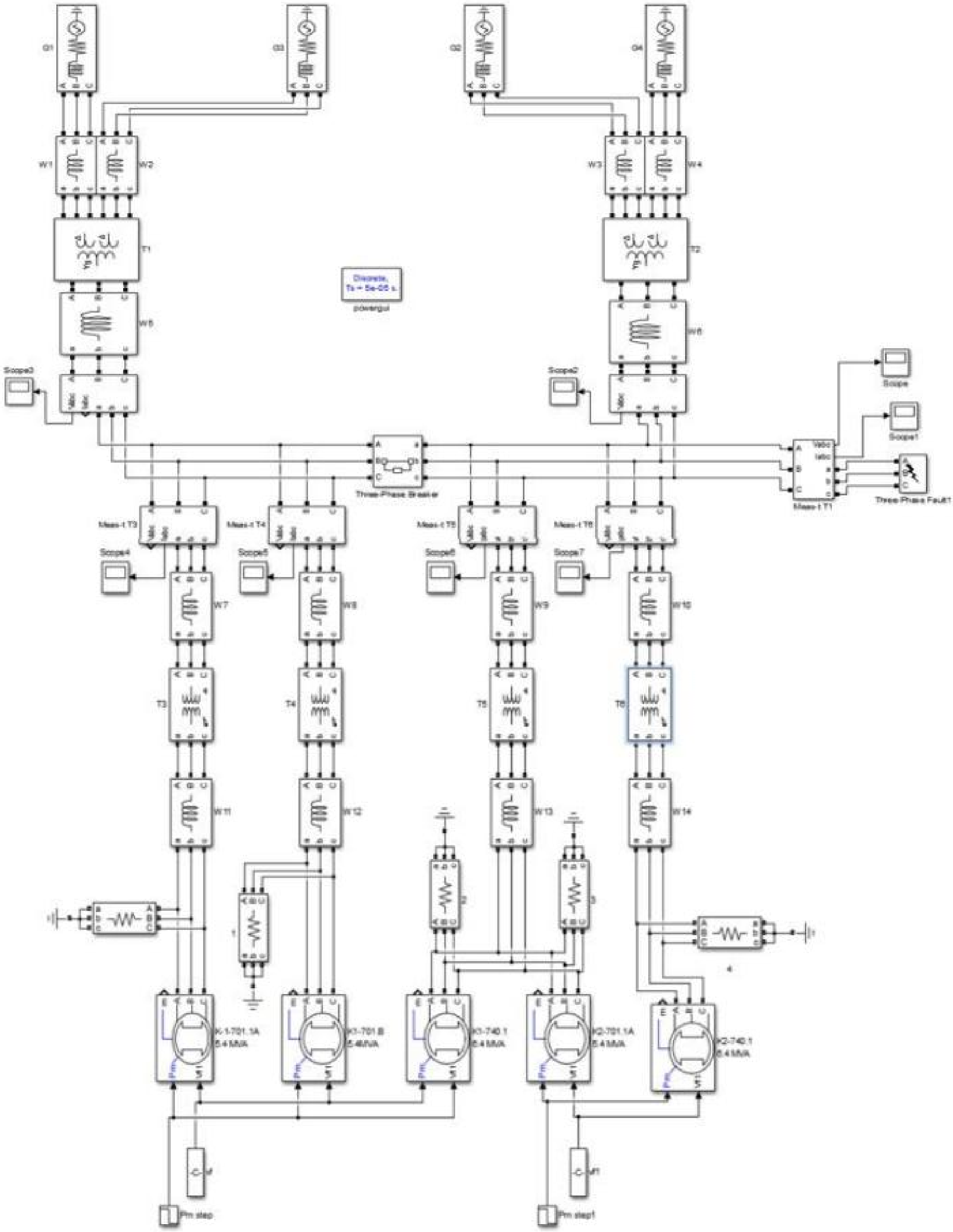

Figure 2 shows the assembled model of the power system in MATLAB.

Table 1 shows the main passport data of the transformers installed at the central distribution point.

Table 1 – values of

Параметр	T5	T6
Номиналы - первичная / вторичная / третичная обмотка (МВА)	80/40/40 (ONAN) 100/50/50 (ONAF)	
Номинальное напряжение обмотки трансформатора - первичная / вторичная / третичная (кВ)	37/10,5/10,5	
Группа соединений трансформатора - первичная / вторичная / третичная обмотка	Yn/d11/ d11 (ток замыкания на землю на обмотке 37 кВ ограничен до 830А)	
Полное сопротивление прямой последовательности (% на основе 80 МВА) - от первичной до вторичной обмотки	27,7	27,7
Полное сопротивление прямой последовательности (% на основе 80 МВА) - от первичной до третичной обмотки	27,8	27,7
Полное сопротивление прямой последовательности (% на основе 80 МВА) - от вторичной до третичной обмотки	48,6	48,6
Коэффициент X/R - от первичной до вторичной обмотки	35	
Коэффициент X/R - от первичной до третичной обмотки	34	
Коэффициент X/R - от вторичной до третичной обмотки	26	
Допустимое отклонение полного сопротивления	0%	
Переключатель ответвлений	Под нагрузкой на обмотке 37 кВ Диапазон +/- 15%, шаг 1,25% 25 положений отпаек (не оборудованы автоматическим контролем напряжения с SRCS (высоко-инерционная система управления)	
Изменение полного сопротивления при положении отпайки -5%	-1,8%	-1,7%
Изменение полного сопротивления при положении отпайки +5%	2,3%	2,2%

parameters included in the STAGE of transformers T5 and T6

In the process of modeling signals in accordance with Table 2 [5], approximate values of power P_X and P_K for parameters of two types of reactive - P_m and inductive - L_m components for transformers with a capacity of 100 MVA and 50 MVA are determined . are given.
For T1-T2 (100 MVA): $C_n = 100$ MVA, $U_b = 37$ kV, $U_n = 11$ kV, $U_c = 10\%$,
$I_0 = 1.3\%$, $R_K = 350$ kW, $R_X = 70$ kW.
Calculated data: $R_m = 1432.9$ Ohm, $L_m = 0.426$ Ohm, $R_1 = 0.005$ Ohm, $R_2 = 0.0015$ Ohm.
Figure 3 shows the parameters of the model of transformers T1 and T2.
For T3-T6 (50 MVA): $S_n = 50$ MVA, $U_b = 37$ kV, $U_{sp} = 11$ kV, $U_K = 10\%$, $I_0 = 1.3\%$, $P_K = 350$ kW, $P_X = 70$ kW.
Calculated data: $R_m = 1142.9$ Ohm, $L_m = 0.98$ H, $R_1 = 0.005$ Ohm, $R_2 = 0.0015$ Ohm, $L_1 = 275e\text{-}6$ H, $L_2 = 88.6e\text{-}6$ H

INTERNATIONAL MULTIDISCIPLINARY JOURNAL FOR RESEARCH & DEVELOPMENT
SJIF 2019: 5.222 2020: 5.552 2021: 5.637 2022:5.479 2023:6.563 2024: 7,805
eISSN :2394-6334 https://www.ijmrd.in/index.php/imjrd Volume 11, issue 12 (2024)

Figure 4 shows the parameters of the model of transformers T3 and T6.

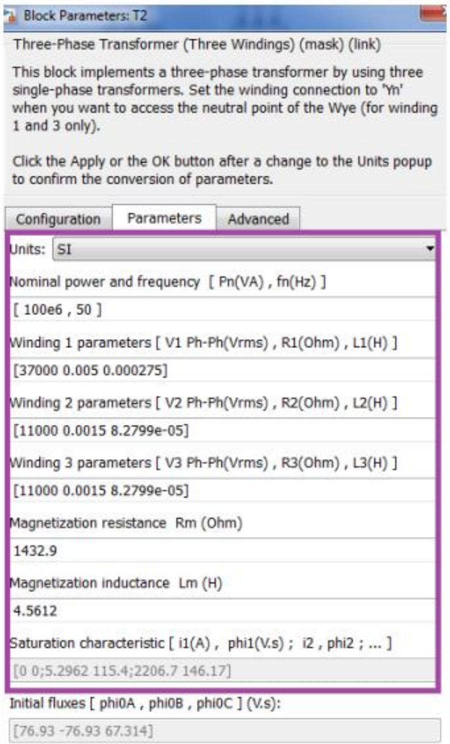

Figure 3 – parameters of the model of transformers T1 and T2

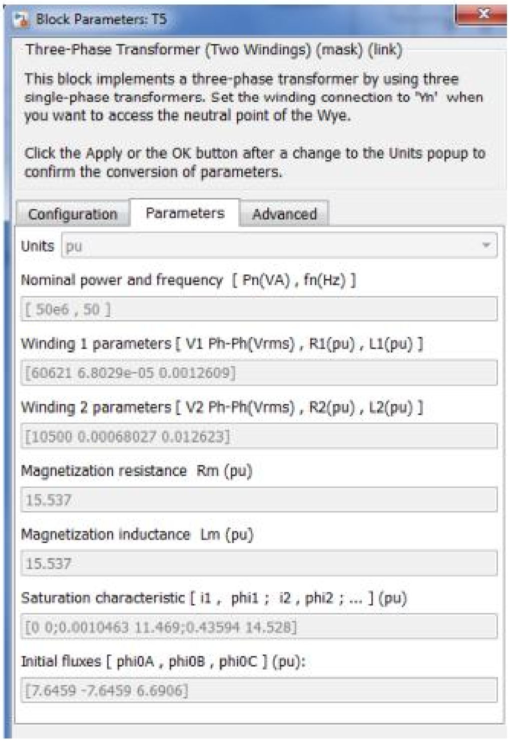

Figure 4 – parameters of the model of transformers T3 and T6

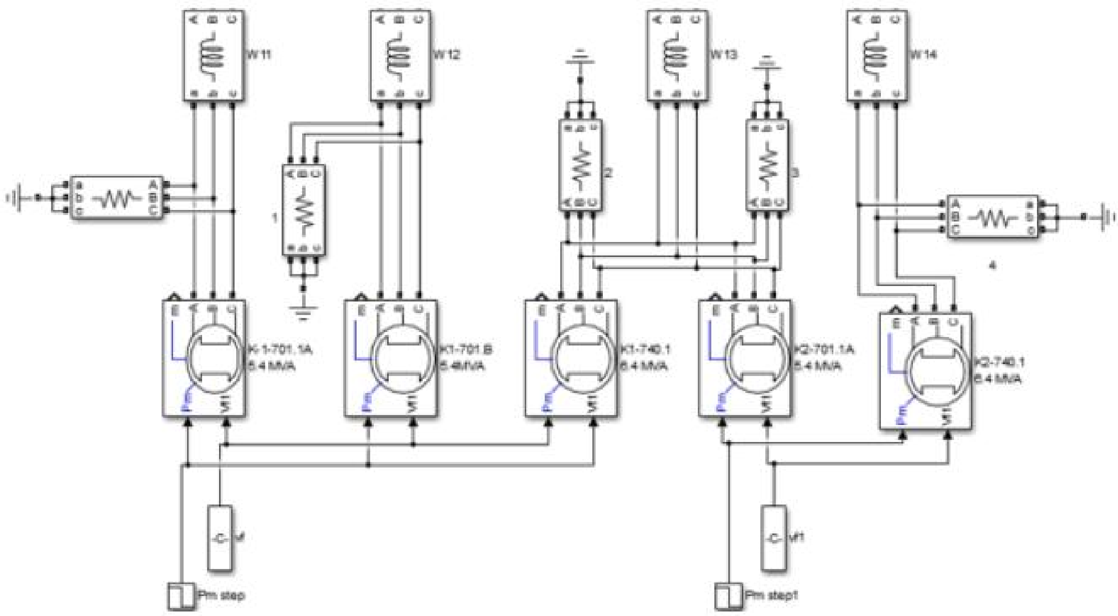

Figure 5 – fragment of the cargo model of the KTL-1 and KTL-2 stations

To simulate a short circuit, the “Three faults” block is used (Fig. 7).

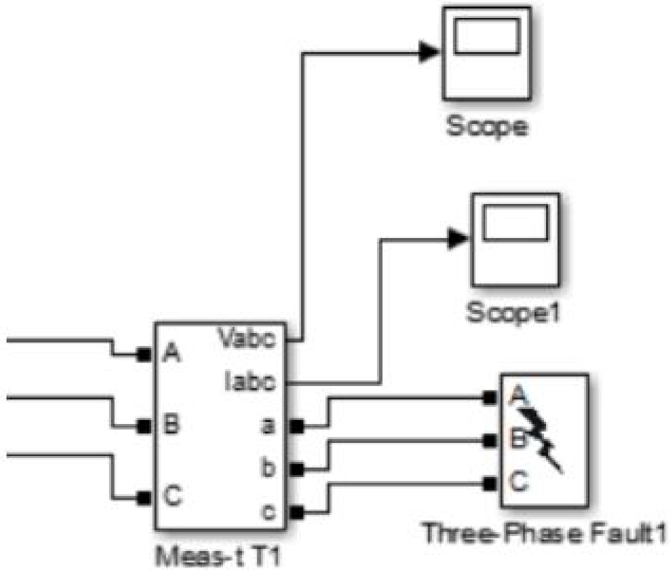

Figure 7 shows the block for simulating the emergency state of point QT1 (3f).

The application area of Vabc is the oscillation of the amplitude of the transient voltage of phases A, B, C (3f) in the transient mode.

Scope1Iabc — Transient fluctuations in the amplitude of short-circuit current.

Modeling is becoming one of the main tools of the innovative direction of electric power engineering. The study of the stability of the energy system in various modes of production and consumption of electrical devices, the state of electrical system devices and relay protection systems can be carried out today in real time using modeling programs and graphical solutions.

This study showed that the developed model can be used as an alternative simulator in production for assessing the energy stability of systems. The model allows for visual analysis of transient processes, investigating network fault modes, and the model can be adjusted in accordance with protection devices, providing computer calculations of short-circuit currents.

REFERENCES

1. Nematillaevna, Z. D. IMPROVING STUDENTS'INDEPENDENT LEARNING ACTIVITY WHEN TEACHING THEORETICAL ELECTRONICAL SCIENCE.

2. Zokirova, D. N., & Qosimov, M. U. (2023). SANOAT KORXONALARINI ELEKTR BILAN TA'MINLASH UCHUN ENERGIYA TEJAMKOR TAQSIMLOVCHI TRANSFORMATORLARNI TAHLIL QILISH. *Экономика и социум*, (5-2 (108)), 513-518.

3. Zokirova, D. N., & Sh, T. U. (2023). AVARIYA REJIMIDA ENERGIYA TIZIMINING O'TKINCHI JARAYONLARINI MATLAB SIMULINKDA TADQIQ QILISH. *Экономика и социум*, (5-2 (108)), 502-508.

4. Otamirzaev, O. U., Zokirova, D. N. M., & Sharipov, F. F. (2019). USE OF ENERGY SAVING CABLES IN ELECTRIC ENERGY TRANSFER. *Научное знание современности*, (3), 92-96.

5. Атамирзаев, Т. У., & Зокирова, Д. Н. (2019). Modern technologies and devices with use of secondary energy sources in uzbekistan and in the world. *Научное знание современности*, (2), 39-43.

6. Юсупов, О. Я., Зокирова, Д. Н., Тойчиева, М. О., & Мухиддинова, Ф. Б. (2019). Методы и средства контроля показателей качества электрической энергии. *Экономика и социум*, (3 (58)), 512-515.

SJIF 2019: 5.222 2020: 5.552 2021: 5.637 2022:5.479 2023:6.563 2024: 7,805
eISSN :2394-6334 https://www.ijmrd.in/index.php/imjrd Volume 11, issue 12 (2024)

7. Атамирзаев, Т. У., Зокирова, Д. Н., Абдусатторов, Н. Н., & Исмоилов, Х. А. (2019). Энергосбережения при внедрении в производство асинхронных двигателей с совмещёнными обмотками (адсо). *Экономика и социум*, (3 (58)), 125-128.
8. Sayfullayeva, D. A., Tosheva, N. M., Nematova, L. H., Zokirova, D. N., & Inoyatov, I. S. (2021). Methodology of using innovative technologies in technical institutions. *Annals of the Romanian Society for Cell Biology*, 7505-7522.
9. Zokirova, D. N. (2021). Goals And Objectives Of Organizing Independent Work Of Students. *The American Journal of Social Science and Education Innovations*, *3*(01), 179-182.
10. Зокирова, Д. Н. (2021). Integration Of Professional And Educational Disciplines Into Training Of Self-Learning Motivated Students. *Современное образование (Узбекистан)*, (6), 24-28.
11. Nematillaevna, Z. D. (2021). Problems in providing independent learning education and ways to prevent them. *Academicia: An International Multidisciplinary Research Journal*, *11*(1), 1431-1436.
12. Usubovich, O. O., & Nematillaevna, Z. D. (2022). Problems Arising From the Use of the Case-Study Method and Methods of Their Prevention. *Central Asian journal of social sciences and history*, *3*(6), 5-10.
13. Otamirzaev, O. U., & Zokirova, D. N. (2019). PROBLEMS ARISING WHEN APPLYING THE "BOOMERANG" METHOD IN THE COURSE OF TRAINING AND METHODS FOR THEIR ELIMINATION. *Scientific Bulletin of Namangan State University*, *1*(11), 270-274.
14. Usubovich, O. O., & Ne'matillaevna, Z. D. (2022). Methodology of using connecting elements of science in the organization of independent work of the science of hydroelectric power stations.
15. Бекваевич, У. Қ., Отамирзаев, О. У., & Зокирова, Д. Н. (2022). The use of Interactive Methods in the Formation of Independent Thinking of Students and Their Analysis. *Telematique*, 7026-7032.
16. Зокирова, Д. Н., Қурбонова, Ф. Қ., & Хусаинов, Ж. И. Ў. (2022). ҚУРИТГИЧЛАРДА ҚУРИТИЛАДИГАН МЕВАЛАРНИНГ ГИГРОСКОПИК ВА ТЕРМОРАДИАЦИОН ХАРАКТЕРИСТИКАЛАРИНИ ТАДҚИҚ ЭТИШ. *Academic research in educational sciences*, *3*(3), 392-400.