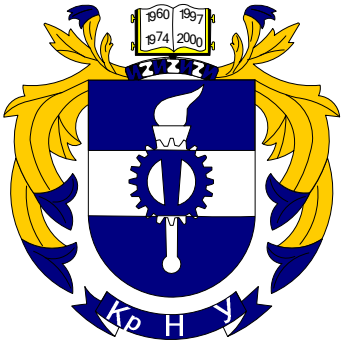
МІНІСТЕРСТВО ОСВІТИ І НАУКИ УКРАЇНИ
КРЕМЕНЧУЦЬКИЙ НАЦІОНАЛЬНИЙ УНІВЕРСИТЕТ
ІМЕНІ МИХАЙЛА ОСТРОГРАДСЬКОГО
ІНСТИТУТ ЕЛЕКТРОМЕХАНІКИ, ЕНЕРГОЗБЕРЕЖЕННЯ
І СИСТЕМ УПРАВЛІННЯ



МЕТОДИЧНІ ВКАЗІВКИ
ЩОДО ВИКОНАННЯ КОНТРОЛЬНОЇ РОБОТИ
З НАВЧАЛЬНОЇ ДИСЦИПЛІНИ
«МІЖНАРОДНА СИСТЕМА ТЕХНІЧНОЇ ТЕРМІНОЛОГІЇ»

ДЛЯ СТУДЕНТІВ ДЕННОЇ ТА ЗАОЧНОЇ ФОРМ НАВЧАННЯ
ЗІ СПЕЦІАЛЬНОСТІ
141 – «ЕЛЕКТРОЕНЕРГЕТИКА, ЕЛЕКТРОТЕХНІКА ТА
ЕЛЕКТРОМЕХАНІКА»
ОСВІТНЬОГО СТУПЕНЯ «МАГІСТР»

КРЕМЕНЧУК 2018

Методичні вказівки щодо виконання контрольної роботи з навчальної дисципліни «Міжнародна система технічної термінології» для студентів денної та заочної форм навчання зі спеціальності 141 – «Електроенергетика, електротехніка та електромеханіка» освітнього ступеня «Магістр»

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ЗМІСТ

ВСТУП

Під час підготовки майбутніх фахівців у галузі «Електроенергетика, електротехніка та електромеханіка» глибокі знання з іноземних мов та з практики перекладу термінології різних галузей науки та техніки є дуже важливими. Однією з навчальної дисциплін, що забезпечують отримання таких знань, є навчальна дисципліна «Міжнародна система технічної термінології».

Метою вивчення цієї навчальної дисципліни є засвоєння необхідних знань з принципів правильного тлумачення міжнародної технічної термінології, формування твердих практичних навичок з перекладу джерел технічної інформації, отримання навичок викладення результатів науково-дослідної роботи іноземною мовою, що є необхідним для виконання таких **завдань:**

1) вивчення словника термінологічних словосполучень;

2) вивчення словника абревіатур;

3) переклад науково-технічного тексту українською мовою;

4) написання тез доповідей за темою досліджень магістерської роботи з використанням отриманих у рамках вивчення навчальної дисципліни знань;

5) підготовка презентації, що відображає написані тези доповідей, за напрямом досліджень магістерської роботи.

Особливість опанування техніки перекладу науково-технічних текстів для денної та заочної форм навчання полягає в тому, що обсяг самостійної роботи студента з удосконалення мовних навичок і вмінь повинен значно перевищувати обсяг практичних аудиторних занять з викладачем. Тому у цих методичних вказівках також запропоновано тексти для самостійного перекладу і контрольні завдання для письмового перекладу.

У результаті вивчення навчальної дисципліни студент повинен:

знати: загальні правила перекладу міжнародних термінів, що складаються як з окремих слів, так і словосполучень; принципи перекладу дієслів у пасивному стані, інфінітивних, дієприкметникових, герундійних зворотів; правила перекладу умовних речень і модальних дієслів; принципи використання перетворень на рівні синтаксису; особливості науково-технічного стилю;

уміти: використовувати необхідні засоби та методики аналізу науково-технічного тексту; точно, зі збереженням сенсу, перекладати спеціалізовані науково-технічні терміни; виявити співвідношення частини і цілого у реченні з використанням міжнародних термінів; уникати необґрунтованих відступів від тексту оригіналу; самостійно написати анотацію науково-технічної роботи англійською мовою з використанням міжнародної термінології.

1 ЗАВДАННЯ ДО КОНТРОЛЬНОЇ РОБОТИ

Завдання 1. У таблиці наведені англомовні терміни та назви і позначення деяких одиниць виміру з галузі електротехніки та їх визначення. Прочитайте їх та підберіть україномовний аналог кожного з наведених термінів

Англомовний термін	Визначення терміну	Україно-мовний аналог терміна
Alternating voltage	A voltage which periodically changes its polarity polarity	
Alternating current	(AC)- A current which periodically changes its direction	
Alternator	An alternating current generator	
Ambient temperature	The temperature of the air, water, or surrounding earth. Conductor ampacity is corrected for changes in ambient temperature including temperatures below 86°F. The cooling effect can increase the current carrying capacity of the conductor. (Review Section 310-10 of the Electrical Code for more understanding)	
Ammeter	An electric meter used to measure current, calibrated in amperes	
Amplification	Procedure of expanding the strength of a signal	
Amplifier	A device use to increase the strength of a signal	
Amplitude	The maximum value of a wave	
Analog switch	An analog switch (sometimes just called a "switch") is a switching device capable of switching or routing analog signals (meaning signals that can have any level within a specified legal range), based on the level of a digital control signal. Commonly implemented using a "transmission gate," an analog switch performs a function similar to that of a relay	

Arc	Sparking that results when undesirable current flows between two points of dithering potential. This may be due to leakage through the intermediate insulation or a leakage path due to contamination	
Arc-chute	A device that employs the deionization principle to confine and extinguish an arc	
Attenuation	The reduction of a signal from one point to another. For an electrical surge, attenuation refers to the reduction of an incoming surge by a limiter (attenuator). Wire resistance, arresters, power conditioners attenuate surges to varying degrees	
Battery	A device for turning chemical energy into electrical energy	
Battery fuel gauge	A feature or device that measures the accumulated energy added to and removed from a battery, allowing accurate estimates of battery charge level	
Bipolar inputs	An input which accommodates signals both above and below ground	
Booster	A generator inserted in series in a circuit to add or subtract from the circuit voltage	
Busbar	A heavy rigid conductor used for high voltage feeders	
Cable	An assembly of two or more wires	
Capacitance	The property of a capacitor that determines the quantity of electric energy that it can store	
Capacitor	A device consisting of two conducting surfaces separated by an insulator and having the ability of storing electric energy. Also called a condenser	
Circuit	A continuous path for the flow of electricity	
Conductor	Metal wires and cables that allow the flow of electrical current	
Controller	A device or group of devices that serves to govern, in some predetermined manner, the electric power delivered to the apparatus to which it is connected	

Converter	A device which changes electrical energy from one form to another	
Coplanar line	A line which is in the same plane as another line. Any two intersecting lines must lie in the same plane, and therefore be coplanar	
Current	The movement of electrons through a conductor measured in amperes and its symbol is "I"	
Cycle	One complete wave of positive and negative values of an alternating current. (See "Hertz")	
Device	A unit of an electrical system that is intended to carry but not utilize electric energy	
Dialectic	The insulating material between me plates of a capacitor	
Diode	Any two-electrode device that conducts in only one direction	
Direct current	A current is a continuous flaw of electric current from positive to negative poles	
Eddy current	Localized currents induced in an iron core by alternating magnetic flux. These currents translate into losses (heat) and their minimization is an important factor in lamination design	
Efficiency	The efficiency of an electrical machine or apparatus is ;he ratio of its useful power output to its total power input	
Electromotive force	A synonym for voltage, usually restricted to generated voltage	
Embeded system	A system in which the computer (generally a microcontroller or microprocessor) is included as an integral part of the system	
Enclosure	The case or housing of apparatus, or the fence or walls surrounding an installation to prevent personnel from accidentally contacting energized parts or to protect the equipment from physical damage	
Energized	Electrically connected to a source of voltage	
Energy	The capacity for doing work	

Equipment	A general term including material, fittings, devices, appliances, luminaires (fixtures), apparatus, and the like used as a part of, or in connection with, an electrical installation	
Equipment grounding conductor	The conductor used to connect ;he non-current-carrying metal pans of equipment, raceways, and other enclosures to the system grounded conductor, the grounding electrode conductor, or both, at the service- equipment or at the source of a separately derived system	
Explosionproof	Apparatus enclosed in a case that is capable of withstanding an explosion of a specified gas or vapor that may occur within it and of preventing the ignition of a specified gas or vapor surrounding the enclosure by sparks, flashes, or explosion of the gas or vapor within, and that operates at such an external temperature that a surrounding flammable atmosphere will not be ignited thereby	
Farad	The unit of measure for capacitance. It is the capacitance of a capacitor in which an applied voltage of one volt will store a charge of one coulomb. The more practical units of capacitance are the microfarad and picofarad	
Feeder	All circuit conductors between the service equipment, the source of a separately derived system, or other power supply source and the final branch-circuit over current device	
Field	A term commonly used to describe the stationary (Stator) member of a DC Motor. The field provides the magnetic field with which the mechanically rotating (Armature or Rotor) member interacts	
Filament	In a directly he2ted electric tube, a hearing element which also serves as the emitter	
Flux	The magnetic field watch is established around an energized conductor *or* permanent magnet The field ;s represented by flux lines creating a flux pattern between opposite poles. Tile density of the flux lines is a measure of the strength of the magnetic field	
Form factor	The ratio of the r.m.s. to the average value of a periodic wave	

Frequency	The rate at which alternating current makes a complete cycle of reversals. It is expressed in cycles per second. In the U.S. 60 cycles (Hz) is the standard while in other countries 50 Hz (cycles) is more common. The frequency of the AC will affect the speed of a motor	
Full load current	The current, flowing through she Ime when the motor LS operating at fuil-load torque and ruLL-load speed with rated frequency and voltage appLLed to the motor TermLoals	
Full load current	The current flowing through the line when the motor is operating at full-load torque and full-load speed with rated frequency and voltage applied to the motor terminals	
Fuse	An overcurrent protective device with a circuit opening fusible part that is heated and severed by the passage of overcurrent through it	
Generator	A machine designed for the production of electric power	
Ground	A conducting connection, whether intentional or accidental, between an electrical circuit or equipment and the earth or to some conducting body that serves in place of the earth	
Grounded	Connected to earth or to some conducting body that serves in place of the earth	
Grounded conductor	A system or circuit conductor that is intentionally grounded	
Grounding conductor	A conductor used to connect equipment or the grounded circuit of a wiring system to a grounding electrode or electrodes	
Harmonic distortion	The presence of frequencies in the output of a device that are not present in the- input signal-	
Henry	The basic unit of inductance. One henry is the inductance which induces a cemf of 1 volt when the current is changing at the rate of 1 ampere per second	
Hertz	A measurement of frequency. One hertz is equal to one inverse second (1/s); that is, one cycle per second, where a cycle is the duration between similar portions of a wave. HZ	
High voltage	Voltage exceeds 600 volts	

Hydroelectric power	Power produced by using the power of water to turn the shaft of a generator	
Impedance	Forces which reststcurrent fiaw in AC circuits, *tjc.* resistance, inductive reactance, capacitive reactance	
Inductance	The ability of a coil to store energy and oppose changes in current flowing through it. A function of the cross sectional area, number of turns of coil, length of coil and core material	
Induction motor	An alternating current motor, either single phase or polyphase, comprising independent primary and secondary windings, in which the secondary receives power from the primary by electromagnetic induction	
Inductive load	An inductive load is a toad in which the current Lags behind the voltage across the load. (See Non-inductive Load)	
Instrument transformer	A transformer (current or potential) suitable for use with measuring instruments; i.e., one in which the conditions of the current, voltage and phase angle in the primary circuit are represented with acceptable accuracy in the secondary circuit	
KVA	(Kilovolt amperes) (volts times amperes) divided by 1000. 1 KVA=1000 VA. KVA is actual measured power (apparent power) and is used for circuit sizing	
KW	(Kilowatts) watts divided by 1000. KW is real power and is important in sizing Uninterruptible Power Supplies, motor generators or other power conditioners. One thousand watts. Expressed by kW	
KWH	(Kilowatt hours) KW times hours. A measurement of power and time used by utilities for billing purposes	
Lagging toed	An inductive load with current lagging voltage. Since inductors tend to resist changes in current, the current flow through an inductive circuit will lag behind the voltage. The number of electrical degrees between voltage and current is known as the "phase angle". The cosine of this angle is equal to the power factor (linear loads only)	

Linear load	A load in which the current relationship to voltage is constant based on a relatively constant load impedance	
Linear regulator	A voltage regulator that is placed between a supply and the load and provides a constant voltage by varying its effective resistance	
Litium-ion battery	Lithium and lithium-ion: A number of battery chemistries are based on the element lithium, a highly-reactive metallic element. Lithium-based batteries are common in two applications: Power for portable equipment such as cell phones, laptops, and MP3 players; and low-power, long-life applications such as powering memory elements and clocks	
Live pans	Energized conductive components	
Load	The amount of power used	
Load, balancing	Switching the various loads on a multi-phase feeder to equalize the current in each line	
Merphy"s law	"Anything that can go wrong, will"	
Motor	A machine which converts electrical power into mechanical power	
Motor control center	An assembly of one or more enclosed sections having a common power bus and principally confining motor control units	
Motor induction type	.An alternating current motor, either single phase or polyphase, comprising independent primary and secondary windings, in which the secondary receives power from the primary by electromagnetic induction	
Motor synchronous tvpe	An alternating current motor which operates at the speed of rotation of the magnetic flux	
Motor-generator set	A conversion device consisting of one or more motors mechanically coupled to one or more generators	
Nominal voltage	The normal or designed voltage level	
Non-inductive cad	A non-inductive toad	

Ohm	The derived unit for electrical resistance or impedance; one ohm equals one volt per ampere. The unit of electrical resistance. Represented by R	
Ohmmeter	An instrument for measuring resistance in ohms	
Oscillator	An electronic device for converting dc energy into ac energy	
Outlet	A point on the wiring system at which current is taken to supply utilization equipment	
Output-to-input ratio	The ratio between Lie sensed: current and the output current of the amplifier	
Overcurrent	Any current in excess of the rated current of equipment or the ampacity of a conductor. It may result from overload, short circuit, or ground fault	
Overload	Operation of equipment in excess of normal, full-load rating, or of a conductor in excess of rated ampacity that, when it persists for a sufficient length of time, would cause damage or dangerous overheating. A fault, such as a short circuit or ground fault, is not an overload	
Overvoltage protection	Overvoltage Protector (OVP) refers to a circuit that protects downstream circuitry from damage due to excessive voltage. An OVP monitors the DC voltage coming from an external power source, such as an off-line power supply or a battery, and protects the rest of the connected circuitry using one of two methods: a crowbar clamp circuit or a series-connected switch	
Peak-to-peak value	The maximum voltage change occuring during one cycle of alternating voltage or current. The total amount of voltage between the positive peak and the negative peak of one cycle or twice the peak value	
Period;	The time required for the current to pass through one cycle	
Phase	The factional part of the period of a sinusoidal wave, usually expressed in electrical degrees and referenced to the origin	
Phase angle	(See "Phase Difference")	

Phase difference	The difference in phase between two sinusoidal waves having the same period, usually expressed in electrical degrees. The voltage wave if generally taken as the reference, so in an inductive circuit the current lags the voltage, and in a capacitive circuit the current leads the voltage. Sometimes called the phase angle	
Polyphase	A general term applied to any system of more than a single phase. This term is ordinarily applied to symmetrical systems	
Potential transformer	A transformer designed for shunt or parallel connection in its primary circuit, with the ratio of transformation appearing as a ratio of potential differences	
Power	Rate of work, equals work. divided by time	
Power factor	Watts divided by voltamps (VA), KW divided by KVA. Power factor: leading and lagging of voltage versus current caused by inductive or capacitive loads, and 2) harmonic power factor: from nonlinear current	
Primary	The windings of a transformer which receive energy from the supply circuit	
Pulsating current	Direct current which charges regularly in magnitude	
Rainproof	Constructed, protected, or treated so as to prevent rain from interfering with the successful operation of the apparatus under specified test conditions	
Raintight	Constructed or protected so that exposure to a beating rain will not result in the entrance of water under specified test conditions	
Rating	The rating of an electrical device includes (1) the normal r.m.s. current which it is designed to carry, (2) the normal r.m.s. volt-age of the circuit in which it is intended to operate, (3) the normal frequency of the current and the interruption (or withstand) rating of the device. (See Interrupting Rating)	

Reactance	Opposition to the flow of alternating current. Capacitive reactance is the opposition offered by capacitor, and inductive reactance is the opposition offered by a coil or other inductance	
Reactive factor	The ratio of the reactive volt-amperes to the apparent power	
Reactive volt amperes	The product of the voltage, current and the sine of the phase difference between them. Expressed in vars	
Rectifier	An electrical device used to change AC power into DC power. A battery charger is a reed tier	
Relay	A device which is operative by variation in the conditions of one electric circuit to effect the operation of other devices in the same or another electric circuit	
Remote-control circuit	Any electric circuit that controls any other circuit through a relay or an equivalent device	
Resistance	Resistance, represented by the symbol R and measured in ohms, is a measure of the opposition to electrical flow in DC systems. Resistance is the voltage across an element divided by the current (R = V/I)	
Rheostat	An adjustable resistor constructed so that its resistance may be changed without opening the circuit:	
Rotor	The rotating member of a generator	
Secondary	The windings which receive the energy by induction from the primary	
Single- phase	A term characterizing a circuit energized by a single alternating voltage source	
Slip rings	The rotating contacts which are connected to the loops of a generator	
Smart phone	A phone with a microprocessor, memory, screen, and built-in modem. The smart phone combines some of the capabilities of a PC in a handset device and typically include Internet connectivity	

Solar photovoltaic system	The total components and subsystems that, in combination, convert solar energy into electrical energy suitable for connection to a utilization load	
Stator	The stationary coils of a generator	
Structure	That which is built or constructed	
Surge	A short duration high voltage condition	
Synchronous motor	An alternating current motor which operates as. the speed of rotation of the magnetic flux	
Thermal protector	(as applied to motors). A protective device for assembly as an integral part of a motor or motor-compressor that, when properly applied, protects the motor against dangerous overheating due to overload and failure to start	
Thermally protected	(as applied to motors). The words Thermally Protected appearing on the nameplate of a motor or motor-compressor indicate that the motor is provided with a thermal protector	
Three phase	A term characterizing a combination of three circuits energized by alternating voltage sources which differ in phase by one-third of a cycle, 120 degrees	
Transformer	A static electrical device which , by electromagnetic induction, regenerates AC power from one circuit into another. Transformers are also used to change voltage from one level to another. See also: Potential Transformer, Current Transformer, Instrument Transformer, and Autotransformer	
Two-phase	A term characterizing a combination of two circuits energized by alternating voltage sources which differ in phase by a quarter of a cycle, 90 degrees.	
Ventilated	Provided with a means to permit circulation of air sufficient to remove an excess of heat, fumes, or vapors	
Volt	The unit of voltage or potential difference. The unit of electromotive force, electrical pressure, or difference of potential. Represented by E or V	
Volt Ampere	The product of the voltage across a circuit and the current in the circuit. Expressed in VA	

Voltage	Electrical pressure, she force which causes current to flow through a conductor	
Voltage (of a circuit)	The greatest root-mean-square (rms) (effective) difference of potential between any two conductors of the circuit concerned	
Voltage drop	The loss of voltage between the input to a device and the output from a device due to the internal impedance or resistance of the device. In all electrical systems, the conductors should be sized so that the voltage drop never exceeds 3% for power, heating, and lighting loads or combinations of these. Furthermore, the maximum total voltage drop for conductors for feeders and branch circuits combined should never exceed 5%	
Voltage ratio	The voltage ratio of a transformer is the ratio of the r.m.s. primary terminal voltage to the r.m.s. secondary cur-rent, under specified conditions of load	
Voltage to ground	For grounded circuits, the voltage between the given conductor and that point or conductor of the circuit that is grounded; for ungrounded circuits, the greatest voltage between the given conductor and any other conductor of the circuit	
Voltage, nominal	A nominal value assigned to a circuit or system for the purpose of conveniently designating its voltage class (e.g., 120/240 volts, 480Y/277 volts, 600 volts). The actual voltage at which a circuit operates can vary from the nominal within a range that permits satisfactory operation of equipment	
Watt.	The unit of power. Equal to one joule per second. The unit of electrical power. Represented by F or W	
Weatherproof	The unit of power. Equal to one joule per second. The unit of electrical power. Represented by P or W	

Завдання 2. Варіант 1. Перекладіть текст «Magnetic effect of an electric current» українською мовою, користуючись словами та словосполученнями, наведеними у словнику

VOCABULARY

obvious – очевидно
to attract – притягувати,
nail – цвях,
to scatter – розкид(ув)ати
to exert – викликати (дію)
to diverge – переломлювати
to suspend – підвішувати
loop – контур
source – джерело
iron bar –залізна решітка
to repel – відштовхувати
paper clip – скріпка для паперу
to surround – оточувати
sink – приймач, стік
to converge – з'єднуватись
resemblance – подібність

MAGNETIC EFFECT OF AN ELECTRIC CURRENT

Most of us are familiar with the more obvious properties of magnets and compass needles. A magnet, often in the form of a short iron bar, will attract small pieces of iron such as nails and paper clips. Two magnets will either attract each other or repel each other, depending upon their orientation. If a bar magnet is placed on a sheet of paper and iron filings are scattered around the magnet, the iron filings arrange themselves in a manner that reminds us of the electric field lines surrounding an electric dipole. All in all, a bar magnet has some properties that are quite similar to those of an electric dipole.

The region of space around a magnet within which it exerts its magic influence is called a magnetic field, and its geometry is rather similar to that of the electric field around an electric dipole – although its nature seems a little different. The geometry of the magnetic field (demonstrated, for example, with iron filings) then greatly resembled the geometry of an electric dipole field. Indeed it looked as though a magnet had two poles (analogous to, but not the same as, electric charges), and that one of them acts as a source for magnetic field lines (i.e. field lines diverge from it), and the other acts as a sink (i.e. field lines converge to it). Rather than calling the poles "positive" and "negative", we somewhat arbitrarily call them "north" and

"south" poles, the "north" pole being the source and the "south" pole the sink. By experimenting with two or more magnets, we find that like poles repel and unlike poles attract.

We also observe that a freely-suspended magnet (i.e. a compass needle) will orient itself so that one end points approximately north, and the other points approximately south, and it is these poles that are called the "north" and "south" poles of the magnet. Since unlike poles attract, we deduce that Earth itself acts as a giant magnet, with a south magnetic pole somewhere in the Arctic and a north magnetic pole in the Antarctic. The Arctic magnetic pole is at present in Bathurst Island in northern Canada and is usually marked in atlases as the "North Magnetic Pole", though magnetically it is a sink, rather than a source. The Antarctic magnetic pole is at present just offshore from Wilkes Land in the Antarctic continent. The Antarctic magnetic pole is a source, although it is usually marked in atlases as the "South Magnetic Pole".

Unfortunately this means that the Earth's magnetic pole in the Arctic is really a south magnetic pole, and the pole in the Antarctic is a north magnetic pole. The resemblance of the magnetic field of a bar magnet to a dipole field, and the very close resemblance of a "Robison Ball-ended Magnet" to a dipole, with a point source (the north pole) at one end and a point sink (the south pole) at the other, is, however, deceptive. In truth a magnetic field has no sources and no sinks. This is even expressed as one of Maxwell's equations, div B = 0, as being one of the defining characteristics of a magnetic field. The magnetic lines of force always form closed loops. Inside a bar magnet (even inside the connecting rod of a Robison magnet) the magnetic field lines are directed from the south pole to the north pole. If a magnet, even a Robison magnet, is cut in two, we do not isolate two separate poles. Instead each half of the magnet becomes a dipolar magnet itself.

Завдання 2. Варіант 2. Перекладіть текст «Definition of electric circuit» українською мовою, користуючись словами та словосполученнями, наведеними у словнику

VOCABULARY

definition – визначення, чіткість,
device – пристрій
to devise – винаходити
purpose –мета, призначення
dimension – розмір, розмірність
compare – порівнювати
wavelength – довжина хвилі
design – розрахунок, проект
charge – заряд
circuit – електричне коло
electric current – електричний струм
flux, flux field – потік, поле потоку
induction – індукція
particle – частка
junction – з‘єднання
thermocouple – термопара
current density – щільність струму
semiconductor – напівпровідник

DEFINITION OF ELECTRIC CIRCUIT

An electric circuit is a collection of electrical devices and components connected together for the purpose of processing information or energy in electrical form. An electric circuit may be described mathematically by ordinary differential equations, which may be linear or nonlinear, and which may or may not be time varying. The practical effect of this restriction is that the physical dimensions are small compared to the wavelength of electrical signals. Many devices and systems use circuits in their design.

Electric Charge. In circuit theory, we postulate the existence of an indivisible unit of charge. There are two kinds of charge, called negative and positive charge. The negatively charged particle is called an electron. Positive charges may be atoms that have lost electrons, called ions; in crystalline structures, electron deficiencies, called holes, act as positively charged particles. In the International System of Units (SI), the unit of charge is the coulomb (C).

Electric Current. The flow or motion of charged particles is called an electric current. In SI units, one of the fundamental units is the ampere (A). The definition is such that a charge flow rate of 1 A is equivalent to 1 C/s. By convention, we speak of current as the flow of positive charges. When it is necessary to consider the flow of

negative charges, we use appropriate modifiers. In an electric circuit, it is necessary to control the path of current flow so that the device operates as intended.

Voltage. The motion of charged particles either requires the expenditure of energy or is accompanied by the release of energy. The voltage, at a point in space, is defined as the work per unit charge (joules/coulomb) required to move a charge from a point of zero voltage to the point in question.

Magnetic and Dielectric Circuits. Magnetic and electric fields may be controlled by suitable arrangements of appropriate materials. Magnetic examples include the magnetic fields of motors, generators, and tape recorders. Dielectric examples include certain types of microphones. The fields themselves are called fluxes or flux fields. Magnetic fields are developed by magnetomotive forces. Electric fields are developed by voltages (also called electromotive forces, a term that is now less common). As with electric circuits, the dimensions for dielectric and magnetic circuits are small compared to a wavelength. In practice, the circuits are frequently nonlinear. It is also desired to confine the magnetic or electric flux to a prescribed path.

Sources of Voltage or Electric Potential Difference. A voltage is caused by the separation of opposite electric charges and represents the work per unit charge (joules/coulomb) required to move the charges from one point to the other. This separation may be forced by physical motion, or it may be initiated or complemented by thermal, chemical, magnetic, or radiation causes.

Завдання 2. Варіант 3. Перекладіть текст «Faraday's law of induction» українською мовою, користуючись словами та словосполученнями, наведеними у словнику

VOCABULARY

path – шлях, контур, вітка
produce – представляти, виробляти
intensity – інтенсивність

increase – зростати, збільшуватися
straight – натяг, деформація
coil – виток, котушка
flux linkage – потокозчеплення
complicate – ускладнювати
complicate - ускладнювати
involve – входить до складу
filament – нитка розжарювання, плавка вставка
homopolar – однополюсний
wire – дріт, провід
branch – відгалуження, вітка
permeability – магнітна проникність

FARADAY'S LAW OF INDUCTION

According to Faraday's law, in any closed linear path in space, when the magnetic flux surrounded by the path varies with time, a voltage is induced around the path equal to the negative rate of change of the flux in webers per second. The minus sign denotes that the direction of the induced voltage is such as to produce a current opposing the flux. If the flux is changing at a constant rate, the voltage is numerically equal to the increase or decrease in Weber's in 1 s.

The closed linear path (or circuit) is the boundary of a surface and is a geometric line having length but infinitesimal thickness and not having branches in parallel. It can vary in shape or position. If a loop of wire of negligible cross section occupies the same place and has the same motion as the path just considered, the voltage n will tend to drive a current of electricity around the wire, and this voltage can be measured by a galvanometer or voltmeter connected in the loop of wire. As with the path, the loop of wire is not to have branches in parallel; if it has, the problem of calculating the voltage shown by an instrument is more complicated and involves the resistances of the branches.

For accurate results, the simple cannot be applied to metallic circuits having finite cross section. In some cases, the finite conductor can be considered as being divided into a large number of filaments connected in parallel, each having its own

induced voltage and its own resistance. In other cases, such as the common ones of D.C. generators and motors and homopolar generators, where there are sliding and moving contacts between conductors of finite cross section, the induced voltage between neighboring points is to be calculated for various parts of the conductors. These can then be summed up or integrated. For methods of computing the induced voltage between two points, see text on electromagnetic theory. In cases such as a D.C. machine or a homopolar generator, there may at all times be a conducting path for current to flow, and this may be called a circuit, but it is not a closed linear circuit without parallel branches and of infinitesimal cross section, and therefore, does not strictly apply to such a circuit in its entirety, even though, approximately correct numerical results can sometimes be obtained. If such a practical circuit or current path is made to enclose more magnetic flux by a process of connecting one parallel branch conductor in place of another, then such a change in enclosed flux does not correspond to a voltage.

Although it is possible in some cases to describe a loop of wire having infinitesimal cross section and sliding contacts for which gives correct numerical results, the equation is not reliable, without qualification, for cases of finite cross section and sliding contacts. It is advisable not to use equations involving t directly on complete circuits where there are sliding or moving contacts. Where there are no sliding or moving contacts, if a coil has N turns of wire in series closely wound together so that the cross section of the coil is negligible compared with the area enclosed by the coil, or if the flux is so confined within an iron core that it is enclosed by all N turns alike, the voltage induced in the coil is In such a case, N is called the number of interlinkages of lines of magnetic flux with the coil, or simply, the flux linkage.

For the preceding equations, the change in flux may be due to relative motion between the coil and the magnetomotive force (mmf, the agent producing the flux), as in a rotating-field generator; it may be due to change in the reluctance of the magnetic circuit, as in an inductor-type alternator or microphone, variations in the primary current producing the flux, as in a transformer, variations in the current in the secondary coil itself, or due to change in shape or orientation of the loop of coil.

Завдання 2. Варіант 4. Перекладіть текст** «DC, AC sources» **українською мовою, користуючись словами та словосполученнями, наведеними у словнику

VOCABULARY

deliver – звільняти
utilization – використання
finding – висновок
efficient – кваліфікований, ефективний
excitable – збуджений
complet – повний, завершений
transient – перехідний, нестаціонарний
particular – особливий, особовий
precede – передувати

DC, AC SOURCES

DC Sources. Some sources, such as batteries, deliver electric energy at a nearly constant voltage, and thus they are modeled as constant voltage sources. The term dc sources basically means direct-current sources, but it has come to stand for constant sources as well.

AC Sources. Most of the electric energy used in the world is generated, distributed, and utilized in sinusoidal form. Thus, beginning with Charles P. Steinmetz, a German-American electrical engineer, much effort has been devoted to finding efficient ways to analyze and design circuits that operate under sinusoidal excitation conditions. Sources of this type are frequently called ac (for alternating current) sources.

The most general expression for a voltage in sinusoidal form is of the type

$$v(t)=V_m\cos(2\pi f+\alpha)= V_m\cos(\omega t+\alpha)$$

and, for a current

$$i(t)=I_m\cos(2\pi f+\beta)= I_m\cos(\omega t+ \beta).$$

Some writers use sine functions instead of cosine functions, but this has only the effect of changing the angles α and β. These expressions have three identifying characteristics, the maximum or peak value (V or I), the phase angle (α or β), and the frequency *f*, measured in hertz (Hz) or cycles per second, or ω , measured in radians/second.

A powerful method of circuit analysis depends on these observations. It is called phasor analysis. The Imaginary Operator. A term that arises frequently in phasor analysis is the imaginary operator

$$j=\sqrt{-1}.$$

Electrical engineers use *j*, since i is reserved as the symbol for current. Mathematicians, physicists, and others are more likely to use *i* for the imaginary operator.

Euler's Relation. A relationship between trigonometric and exponential functions, known as Euler's relation, plays an important role in phasor analysis. The equation is

$$e^{jx} = \cos x + j \sin x$$

If this equation is solved for the trigonometic terms, the result is

$$\cos x = (e^{jx} + e^{-jx})/2;$$

$$\sin x = (e^{jx} - e^{-jx})/2.$$

In phasor analysis, this equation is used by writing it as:

$$e^{j(\omega t+\alpha)} = cos(\omega t+\alpha)+j\ cos(\omega t+\alpha).$$

Thus, it is observed that the cosine term in the preceding expressions for voltage and current is equal to the real-part term from Euler's relation. Thus, it will be seen possible to substitute the general exponential term for the cosine term in the source expressions, then, to find the solution (currents and voltages) to the exponential excitation, and finally, to take the real part of the result to get the final answer.

Steady-State Solutions. When the complete solution for current and voltage in a linear, stable, time-invariant circuit is found, two types of terms are found. One type of term, called the complementary function or transient solution, depends only on the elements in the circuit and the initial energy stored in the circuit when the forcing function is connected. If the circuit is stable, this term typically becomes very small in a short time. The second type of term, called the particular integral or steady-state solution, depends on the circuit elements and configuration and also on the forcing function. If the forcing function is a single-frequency sinusoidal function, then it can

be shown that the steady-state solution will contain terms at this same frequency but with differing amplitudes and phases. The goal of phasor analysis is to find the amplitudes and phases of the voltages and currents in the solution as efficiently as possible, since the frequency is known to be the same as the frequency of the forcing function.

Завдання 2. Варіант 5. Перекладіть текст «Reactive voltamperes» українською мовою, користуючись словами та словосполученнями, наведеними у словнику

VOCABULARY

average – середнє арифметичне
unchange – незмінний
conversion – перетвореннння, зміна
network – мережа, коло
convene – складати, збирати
pair – пара, двопровідна лінія
measure – міра, вимірювання
essential – суттєвий, важливий
terminal – затискач, кінцевий апарат

REACTIVE VOLTAMPERES

When the voltage across a device and the current through a device are given, respectively, by

$$v(t)= V_m\cos(\omega t+\alpha)$$

and, for a current

$$i(t)= I_m\cos(\omega t+ \alpha)$$

a computation of the power delivered to the device as a function of time shows

$$p(t)= [(V_mI_m)/2] [\cos(\alpha - \beta)+ \cos(\omega t+\alpha+\beta)].$$

In addition to the constant term that represents the average power, there is a double-frequency term that represents energy that is interchanged between the electric and magnetic fields of the device and the source. This quantity is called by the term reactive voltamperes (vars). It may be shown that

$$var=[(V_mI_m)/2] \sin(\alpha - \beta)$$

and

$$\text{var}=(V_{eff}I_{eff})\sin(\alpha-\beta).$$

Power and Vars. If the phasor voltage across a device and the phasor current through the device are given, respectively, by $V_1=V_{eff}e^{j\alpha}$ and $I_1=I_{eff}e^{j\beta}$.

$$\text{VA}= V_{eff}\,I_{eff}^{*}= V_{eff}\,I_{eff}[\cos(\alpha-\beta)+j\sin(\alpha-\beta)],$$

where * represents the complex conjugate, which may be used to find both average power and vars. The real part of the expression is the average power, while the imaginary part is the vars.

Circuit Reduction Techniques. When a circuit analyst wishes to find the current through or the voltage across one of the elements that make up a circuit, as opposed to a complete analysis, it is often desirable to systematically replace elements in a way that leaves the target elements unchanged, but simplifies the remainder in a variety of ways. The most common techniques include series/parallel combinations, wye/delta (or tee/pi) combinations, and the Thevenin-Norton theorem.

Series Elements. Two or more electrical elements that carry the same current are defined as being in series. Figure 1 shows a variety of equivalents for elements connected in series.

Parallel Elements. Two or more electrical elements that are connected across the same voltage are defined as being in parallel.

Wye-Delta Connections. A set of three elements may be connected either as a wye, shown in Fig. 1 a, or a delta, shown in Fig. 1 b. These are also called tee and pi connections, respectively. The equations give equivalents, in terms of resistors, for converting between these connection forms

$$Rc=\frac{R_1R_2+R_1R_3+R_2R_3}{R_1}$$

$$Rb=\frac{R_1R_2+R_1R_3+R_2R_3}{R_2}$$

$$Ra=\frac{R_1R_2+R_1R_3+R_2R_3}{R_3}.$$

In practice, application of one of these conversion pairs will lead to additional series or parallel combinations that can be further simplified.

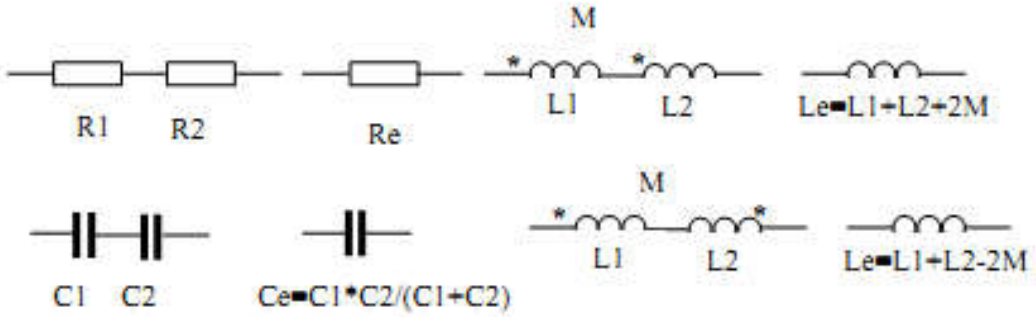

Figure – 1 Parallel-connected elements and equivalents: (a) resistors in parallel; (b) capacitors in parallel; (c) inductors in parallel, aiding fluxes; (d) inductors in parallel, opposing fluxes

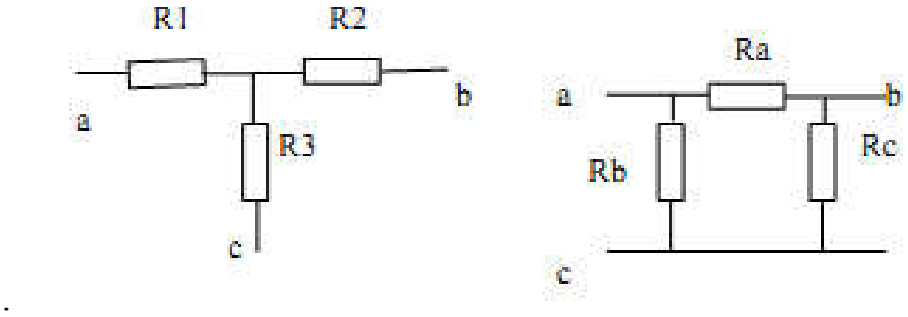

Figure –2 (a) Wye-connected elements; (b) delta- connected elements

Thevenin-Norton Theorem. The Thevenin theorem and its dual, the Norton theorem, provide the engineer with a convenient way of characterizing a network at a terminal pair. The method is most useful when one is considering various loads connected to a pair of output terminals. The equivalent can be determined analytically, and in some cases, experimentally. Terms used in these paragraphs are defined in Fig. 3.

Thevenin Theorem. This theorem states that at a terminal pair, any linear network can be replaced by a voltage source in series with a resistance (or impedance). It is possible to show that the voltage is equal to the voltage at the

terminal pair when the external load is removed (open circuited), and that the resistance is equal to the resistance calculated or measured at the terminal pair with all independent sources de-energized. De-energization of an independent source means that the source voltage or current is set to zero but that the source resistance (impedance) is unchanged. Controlled (or dependent) sources are not changed or de-energized.

Norton Theorem. This theorem states that at a terminal pair, any linear network can be replaced by a current source in parallel with a resistance (or impedance). It is possible to show that the current is equal to the current that flows through the short- circuited, terminal pair when the external load is short circuited, and that the resistance is equal to the resistance calculated or measured at the terminal pair with all independent sources de-energized. De-energization of an independent source means that the source voltage or current is set to zero but that the source resistance (impedance) is unchanged. Controlled (or dependent) sources are not changed or de- energized.

Thevenin-Norton Comparison. If the Thevenin equivalent of a circuit is known, then it is possible to find the Norton equivalent by using the equation $V = IR$ as indicated in Fig. 3.

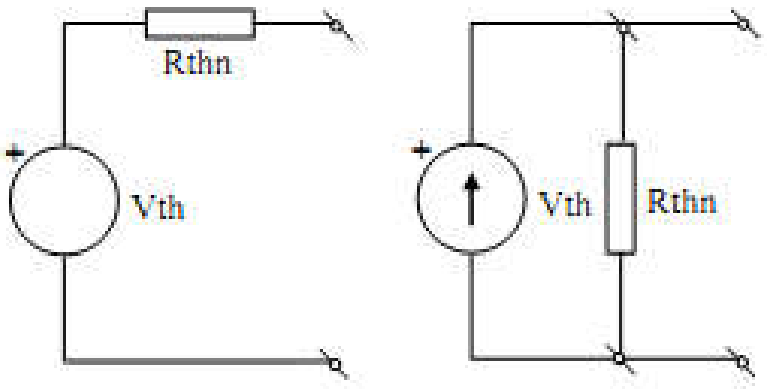

Figure – 3 (a) Thevenin equivalent circuit model; (b) Norton equivalent ciruit model.

Завдання 2. Варіант 6. Перекладіть текст «Automatic control systems» українською мовою, користуючись словами та словосполученнями, наведеними у словнику

VOCABULARY

control system – система керування

desired output – затребуваний (очікуваний, необхідний) вихід (регулятора, системи керування, датчиків координат)
disturbance input – збурюючий вплив
error – похибка
excitation – активізація, збудження
flyweight – центробіжний вантаж
interconnection – взаємозв'язок,

maintain – підтримувати
negative feedback – негативний зворотній зв'язок
open-loop control
closed-loop control
output – вихід

rise – підвищення
value – величина, цінність, вартість
feedback element – давач (пристрій керується) координати для виміру вихідної координати

reference input – вхід для подання сигналу керування
applied – прикладний, практичний
disturbance input – вхід впливу
unwanted effect – небажаний вплив збурення (ефект, наслідок від впливу)
error signal – сигнал за похибкою
increases – збільшення
actual – фактичний, існуючий,
engine – двигун, машина,
governor – регулятор, пристрій керування
prescribe – призначати
controller – регулятор, пристрій керування
system – розімкнена система
system – замкнена система керування
controlled variable – змінна, що керується
feedback – зворотний зв'язок
follow – слідкувати

AUTOMATIC CONTROL SYSTEMS

Automatic Control Systems permeate life in all advanced societies today. Technological developments have made it possible to travel to the moon; explore outer space the space shuttle; space station; robot; industry control, such as the control of temperature, pressure, fluid, lever.

Some Terminologies Control system is an interconnection of components forming a system configuration that will provide a desired system response. Reference input (Desired output): excitation applied to a control system from an

external source. The reference signal produced by the reference selector. It is the actual signal input to control system. Disturbance input: a disturbance input signal to the system that has an unwanted effect on the system output. Output (controlled variable): тhe quantity that must be maintained at a prescribed value, i.e., it must follow the command input without responding to disturbance inputs.

Feedback: тhe output of a system that is returned to modify the input. Error: тhe difference between the input and the output. Open-loop control system: a system in which the output has no effect upon the input signal. Feedback element: тhe unit provides the measurement value for feeding back the output quantity, or a function of the output, in order to compare it with the reference.

Actuating signal (error signal): the signal that is the difference between the reference input and the feedback signal. It is the input to the control unit that causes the output to have the desired value. Negative feedback: the output signal is feed back so that it subtracts from the input signal.

Closed-loop control system – A system in which the output has an effect upon the input quantity in such a manner as to maintain the desired output value. That is, a system that uses a measurement of the output and compares it with the desired output. Control systems are used to achieve: (1) increased productivity; (2) improved performance of a device or system.

The control of an industrial process (manufacturing, production, and so on) by automatic rather than manual means is often called automation. Automation is used to improve productivity and obtain high-quality products. History of automatic control The first automatic feedback controller used in an industrial process is generally agreed to be James Walt's fly ball regulator, developed in 1769 for controlling the speed of a steam engine. Shown in Fig.4.

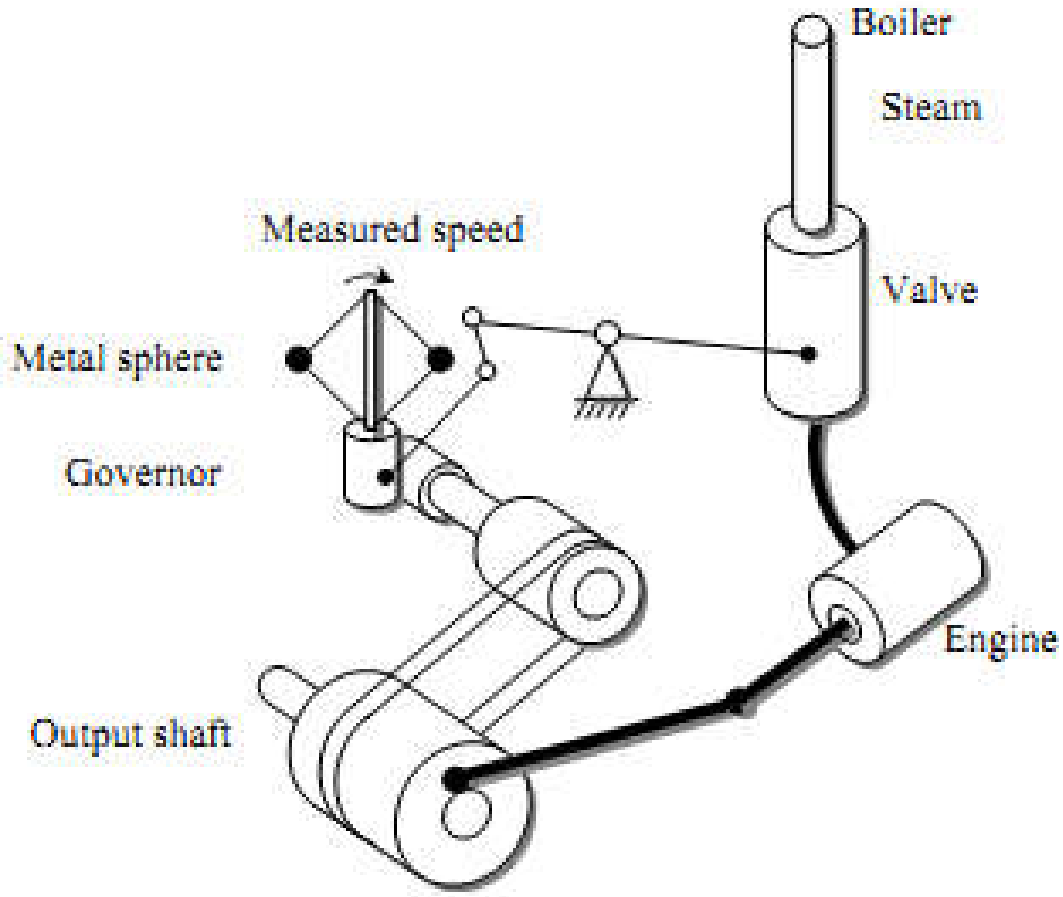

Figure 4 – Fly ball regulator

The all-mechanical device, shown in fig.1. measured the speed of the output shaft and utilized the movement of the flyball with speed to control the valve and therefore the amount of steam entering the engine. As the speed increases, the ball weights rise and move away from the shaft axis, thus closing the valve. The flyweights require power from the engine to turn and therefore cause the speed measurement to be less accurate.

Завдання 2. Варіант 7. Перекладіть текст «Servomechanisms» українською мовою, користуючись словами та словосполученнями, наведеними у словнику

VOCABULARY

academic – академічний, педагогічний, науковий
actuate – приводити в дій, викликати дію
might – енергія, міць

model – модель, макет, шаблон
originally – по-перше, спочатку

pointer – вказівка
attached – прив'язаний, закріплений
power – потужність, міць
bring – приносити, доставляти, призводити

quite – зовсім, цілком, безумовно
recognizing – що розпізнає, впізнає

requirements – затребувані засоби

corresponding – відповідний
response – відповідь, відлуння
restoring – поновлення,

seminal – початковий
sense – сенс

servomechanism - сервопривод
shaft – ручка, вал, вісь
тяжіння, волочіння
effort – спроба, зусилля

equation – вирівняння, стабілізація,

grid – сітка, решітка
grow – збільшувати, підсилюватися,
hardware – металеві вироби, частини (елементи) комп'ютера
support – підтримка, допомога

mathematics – математика
measurement – вимір
alleviate – полегшення, пом'якшення
analog computers – аналоговий комп'ютер
angle – кут
associated – пов'язаний, зчеплений
potentiometer – потенціометр
attempt – спроба
tedious – нудний, затяжний
primarily – на початку, спочатку
broader than the invention – ширше ніж відкриття
certain – точний, визначений
concerned – зацікавлений, зайнятий (чимось),
resilience – гнучкість, еластичність
culture – культура, розвиток
damping – гасіння, демпфування
define – визначати, надавати визначення
describing – зображення, опис
designing – планування, проектування
develop – розвивати
draw – кількість чого небудь,
simply – легко, просто
sliding – диференційний, що сковзає
solve – розв'язувати (задачу), рівняння
statement – заява, формулювання
steering – керування механічної
such as – наприклад
hereinafter cited – у подальшому
human operators – оператор

(машиніст)
incredibly – занадто, через край
indication – вказівка, підказка, знак, позначення
inertia – інерція, інерційність
instead – замість
tend – мати тенденцію
third – третій, третина
torque – момент, що обертає
track – слід, ряд, підхід
knob – вузол, набалдашник
integral – цілий. повний, загальнообємний шароподібна ручка,

SERVOMECHANISMS

Yet a third application of automatic control may be found in the development of analog computers at MIT in the 1930s. Analog computers were used to define a model of a much larger system such as an electrical power grid in the case of Vannevar Bush's Network Analyzer. In order to solve the mathematics associated with these large network problems, Bush also began designing machines to calculate certain integrals. These machines, such as the Product Intergraph, solved integral equations by requiring human operators to track a given signal by sliding a pointer attached to a linear potentiometer. This tracking was subject to human errors as well as being incredibly tedious. To alleviate this problem, one of Bush's students, Harold Hazen, automated this process with the servomechanism. In his 1934 seminal paper on the theory of servomechanisms, Harold Hazen defined a servomechanism as a device whose output element "…is so actuated as to make the difference between the output and input indications tend to zero." In this sense, the servomechanism tracks, or follows, a given input signal. Hazen also described the servomechanism as a power amplifier where low power inputs could be used to control high power outputs. While this statement seems to draw a connection to the feedback amplifiers at Bell Labs, Hazen did not make this connection originally. Instead, describing a servomechanism as a power amplifier simply meant that a small knob connected to a potentiometer drawing very little current could be used to control the position of a high current, high torque motor as shown in Figure 5.

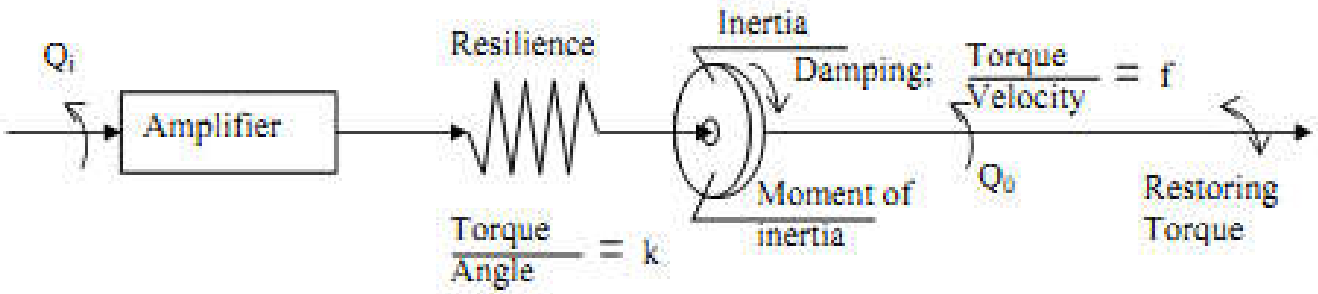

Figure 5 – The servomechanism

Servomechanisms grew up in an academic culture quite different from the industrial culture of process control and feedback amplifiers. As such, while Hazen was primarily concerned with the mechanism itself, he also took time to develop some corresponding theory to support his mechanism. In "Theory of Servo-Mechanisms," Hazen studied the dynamic response and stability which were important aspects of his application. In addition, in a relatively thorough literature review, Hazen cited a large number of papers on process control and automatic steering, recognizing the fact that his work might have a broader outlook. Despite this effort, he did not find the connection to Nyquist's previously published paper from Bell Labs, and it would take a war to bring these groups together. Because the hardware and mechanisms used for process controllers, feedback amplifiers, and servomechanisms were so different, connections between the three subjects were not immediately obvious. However, all three applications attempted to solve similar problems through the use of feeding an output signal back to the input. For example, process controllers were generally designed to maintain a certain measurement or reference point, but this is simply a subset of the signal tracking that feedback amplifiers and servomechanisms accomplished. Hazen made the connection between his work and previous studies of gyro stabilization and industrial controllers in his theory paper, but it appears that in general, very little was communicated between the three groups which emerged independently. Each group contributed its

Завдання 3. Розшифруйте скорочення, що часто зустрічаються в науково-технічній літературі Великобританії та США.

abr.	a. h.	a. m.	amp
at. wt.	b. p.	Br. P.	b. s.
bu	C.	c.	cal
cap	c. c.	c. c. w.	cf.
cfm	cg	Ch.	Cp 1.
cu.	cw	d.	db
d. c.	deg.	doz.	dwg
e. g.	E. M. F.	etc.	F
f. 1.	fig	FM	f. p. m.
f/s	GAT	gr	hf. h.
Hi-Fi,	h. p.	i. e.	I. E. C.
kg.	km.	kvar.	kW.
kWhr.	l.	1b.	LH
m.	mi	mm	mol. wt.
m. p.	m. p. h.	N	NBS
No.	o. d.	oz	P.
p.	p. m.	p. s.	psi
R. f.	R. H.	r. p. m.	sec.
s/n	sp. gr.	sq.	sq. ft.
Tee	tn	vol., V.	yd.

Завдання 4. Написати тези доповідей, за темою досліджень магістерської роботи із використанням ориманих в рамках вивчення навчальної дисципліни знань

Завдання 5. Підготовка презентації, що відобразить написані тези доповідей, за напрямом досліджень магістерської роботи.

2 КРИТЕРІЇ ОЦІНЮВАННЯ ЗНАНЬ СТУДЕНТІВ

Виконання студентами контрольної роботи*:*

- виконання завдання 1 – 3 бали,
- виконання завдання 2 – 4 бали,
- виконання завдання 3 – 2 бали,
- виконання завдання 4 – 7 балів,
- виконання завдання 5 – 4 бали.

Усього: 20 балів.

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