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DEVELOPMENT OF A METHOD FOR INJECTING WATER INTO A RESERVOIR TO MAINTAIN RESERVOIR PRESSURE IN AN OIL FIELD

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Abstract. This article discusses a system for developing an oil reservoir using the pressure of regional waters. The system is used for reservoir-type oil deposits with natural water pressure or active elastic water pressure regime. It involves drilling out the deposit with production wells, locating them mainly in the purely oil part of the deposit in closed ("circular") rows parallel to the internal oil-bearing contour. This includes oil deposits with effective reduced wear regimes of deposits with water-pressure and active elastic-water-pressure regimes. Waterflooding cannot be developed when the permeability of the formations is low. As a result, some deposits are being developed under modern conditions.
Key words: Development system, impact methods, water flooding, oil displacement methods, water pressure regime, elastic water pressure regime, oil-bearing contour.

РАЗРАБОТКА СПОСОБА ЗАКАЧКИ ВОДЫ В ПЛАСТ ДЛЯ ПОДДЕРЖАНИЯ ПЛАСТОВОГО ДАВЛЕНИЯ НА НЕФТЯНОМ МЕСТОРОЖДЕНИИ

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Аннотация. В этой статьи рассмотрены разработка способа закачки воды в пласт для поддержания пластового давления на нефтяном месторождении. Систему применяют для нефтяных залежей пластового типа с природным водонапорным или активным упруговодонапорным режимом. Она предусматривает разбуривание заложи добывающими скважинами с расположением их в основном в чисто нефтяной части залежи замкнутыми («кольцевыми») рядами, параллельными внутреннему контуру нефтеносности. К этому относятся нефтяные залежи с эффективными пониженными режимами от износа залежей с водонапорными и активными упруговодонапорными режимами. Заводнение не

может быть освоено при низкой проницаемости пластов. Вследствие этого некоторые залежи разрабатывают современные режимы.
Ключевые слова: Система разработки, методы воздействия, заводнения, методы вытеснения нефти, водонапорный режим, упруговодонапорный режим, контур нефтеносности.

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Introduction.

The high pace of development of the oil and gas industry of Uzbekistan is inconceivable without improving the methods of exploration and development of oil, gas and gas condensate fields, both in the direction of accelerating exploration, obtaining the necessary initial data for the design and rapid commissioning of fields into development, and increasing the efficiency of each link of a single technological chain: formation-well-gas- and oil-gathering points-ground-based field structures-gas-, oil-pipeline-consumer.

The processes of development and operation of oil and gas fields are closely related to the patterns of filtration of hydrocarbons and water in the rocks that make up the productive formations. Therefore, the properties of rocks and formation fluids predetermine the rational technology for the development of oil and gas deposits and the economic indicators of their extraction from the subsoil [1; 4–5-p.].

The purpose of the work.

Currently, when using natural types of energy, oil deposits with effective natural regimes are being developed, for which artificial impact is not required, as well as deposits with special geological conditions under which impact methods cannot bring the necessary results or cannot be developed.

The use of new development methods (physicochemical, thermophysical, thermochemical, methods of displacing oil with miscible agents), in contrast to the well-developed water flooding method, also has its limitations. As a result, some deposits are developed using natural conditions [2; 235-p.].

It involves drilling out the deposit with production wells, locating them mainly in the purely oil part of the deposit in closed (“circular”) rows parallel to the internal oil-bearing contour. If possible, a staggered order of well locations is observed (Figure 1). To extend the water-free period of well operation, the distances between rows of wells can be set somewhat larger than between wells in rows.

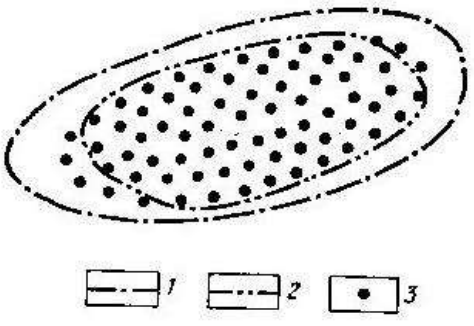

Figure 1. A system for developing an oil reservoir using the pressure of

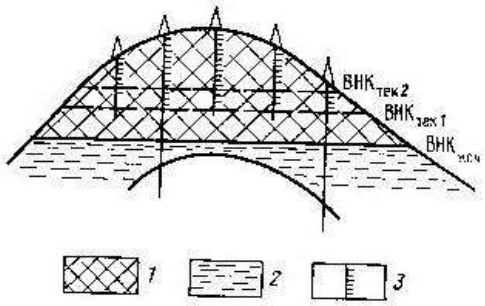

Figure 2. A type of system for developing an oil deposit using the

regional waters.

Oil-bearing contours: 1 – external; 2 – internal; 3 – production wells.

pressure of bottom water.

1 – oil; 2 – water; 3 – perforation interval; position water-oil contact (WOC); WOC_{in} – initial, WOC_{cur} – current

Results and discussion.

The considered placement of wells and their perforation best correspond to the process of introducing marginal water into the reservoir, replenishing the withdrawal of fluid from it. From the oil-water zone, oil is displaced by water to the wells. In the process of development, the oil-bearing contours "contract" and the size of the deposit decreases. Accordingly, the wells of the outer ring row are gradually watered and decommissioned, then, through certain stages, the wells of subsequent rows [3; 285–286-p.].

System using bottom water pressure. The system is used for massive oil deposits that have a water-pressure or active elastic-water-pressure regime. When developing such deposits, the displacement of oil by water is accompanied by a widespread rise in the water-oil contact (WOC), that is, intervals of the deposit located approximately at the same hypsometric marks are sequentially watered; the size of the deposit decreases. The placement of wells on the deposit area and the approach to perforating the productive part of the section depend on the height and other parameters of the deposit. When the height of the deposit is measured in tens of meters, the wells are spaced evenly and the formation in them is perforated from the roof to some conventionally accepted boundary, located several meters away from the OWC (Figure 2).

When the reservoir height is 200-300 m or more (which is typical for some massive deposits in carbonate reservoirs), it is preferable to place wells along a grid condensing towards the center of the reservoir, maintaining the principle of equality of oil reserves per well. In this case, the approach to opening the productive part of the section in wells depends on the filtration characteristics of the deposit. With low oil viscosity - up to 1-2 mPa·s, high permeability and a relatively homogeneous structure of the productive strata, it is possible to open the upper part of the oil-saturated capacity in wells, since under such conditions oil from the lower part can be displaced to the opened intervals. With low oil viscosity and heterogeneous structure of reservoir rocks or with increased oil viscosity, sequential opening of oil-saturated capacity can be realized [4; 161-p.].

Development system using the energy of gas released from oil. The system is used in dissolved gas mode and involves drilling out the production facility, usually along a uniform grid with perforation in all wells of the entire oil-bearing capacity.

Development system with joint use of formation water pressure and gas cap gas. The system for developing the oil part of a gas-oil deposit involves the use of a mixed regime of the deposit and the displacement of oil by contour water and gas from the gas cap. With this system, wells are placed along a uniform grid and only part of the oil-saturated capacity is perforated into them with a significant deviation from the contacts [5; 93–94-p.].

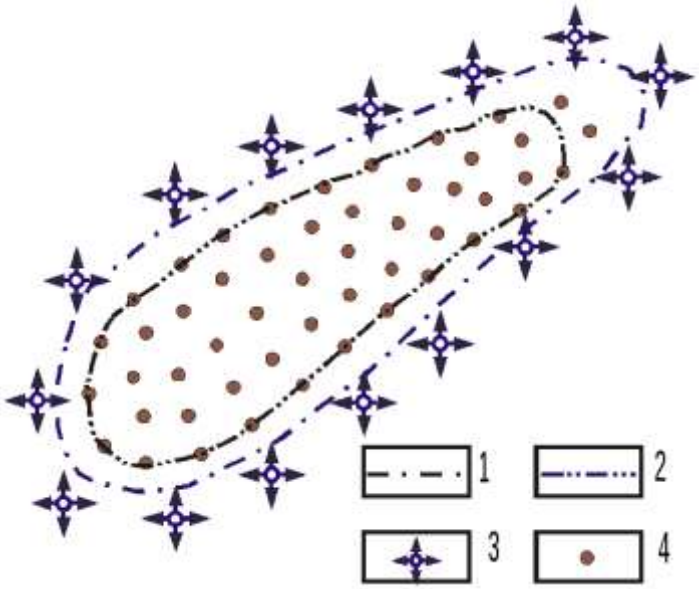

Figure 3. Oil reservoir development system with edge flooding

Oil-bearing contours: 1-external, 2-internal; Wells: 3 – injection, 4 – production.

A system using the pressure of formation water at a stationary GOC (gas-oil circuit). The system provides for the extraction of oil from an oil and gas deposit (with a potentially mixed natural regime) only through the introduction of formation waters with a constant volume of the gas cap. Stabilization of the gas oil reservoir in its initial position is ensured by regulating the pressure in the gas cap by selecting from it through special wells strictly justified volumes of gas corresponding to the rate of pressure reduction in the oil part of the deposit [6; 187–188-p.]. Methods for substantiating optimal perforation intervals when developing the oil part of a deposit, low oil viscosity, high formation permeability, and the presence of impermeable layers in the formation section that increase its anisotropy.

Water flooding method in different geological conditions. The use of the water flooding method for the development of oil and gas-oil production facilities with different characteristics has led to the need to create variations of the method (Figure 3), each of which is most appropriate in certain geological conditions.

The next step in the development of the water flooding method was the transition in a number of deposits to peripheral water flooding. Bringing the artificial feed circuit closer to the extraction zone in this way increased the capabilities of the water flooding method [7; 207–208-p.]. Erosive types of intra-circuit flooding have been developed and the geological field conditions in which they are most acceptable have been determined (Figure 4).

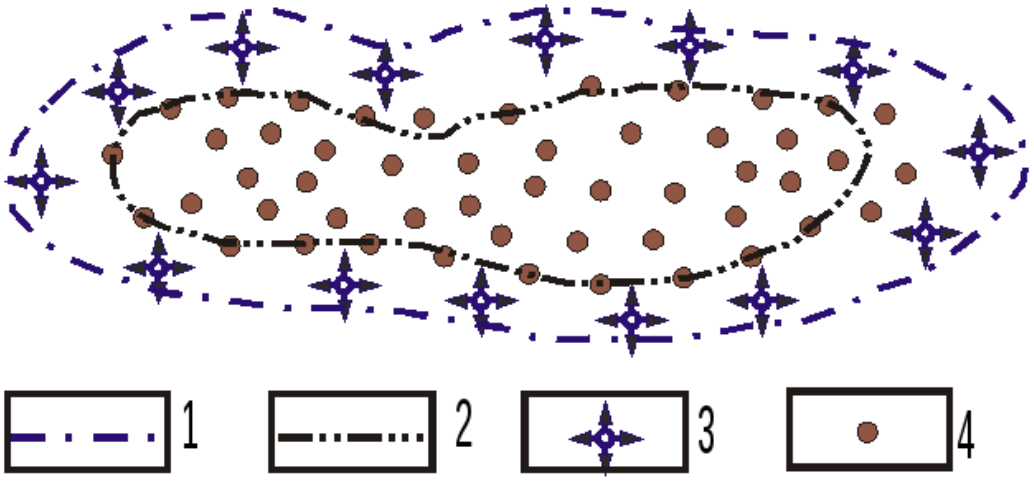

Figure 4. Oil reservoir development system with peripheral flooding
Oil-bearing contours: 1-external, 2-internal; Wells: 3 – injection, 4 – production.

New methods for developing oil deposits and geological conditions for their use. It is currently customary to call new development methods all methods of influencing the formation that differ from the widely used water flooding method. New methods are needed to develop oil deposits where water flooding cannot be applied at all, for production facilities where traditional water flooding does not provide high oil recovery rates [8; 368–369-p.]. Many new methods are expensive and require the use of scarce reagents or complex equipment, so when designing and implementing them, special attention should be paid to economic issues.

Water flooding using chemical reagents. This group of new methods is based on injecting aqueous solutions of chemicals with a concentration of 0.02-0.2% into productive formations. Solutions are injected in a volume of 10-30% of the total volume of reservoir voids to create a rim that displaces oil [9; 178-p.]. With their help, the range of reservoir oil viscosity values can be significantly expanded (up to 50-60 mPa·s), at which it is possible to use impact methods based on water flooding. The use of methods in the initial stages of development allows us to expect an increase in oil recovery factors compared to their value under normal conditions. Water flooding by 3-10%.

The most suitable solution for this process is considered to be a solution of polyacrylamide (PAA) using the lime neutralization method. The addition of PAA to the injected water increases its viscosity and, therefore, reduces the relative viscosity of the reservoir oil: $\mu_0 = \mu_n/\mu_{in}$.

The method is recommended for deposits with high reservoir oil viscosity-10-50 mPa·s. Taking into account the possibility of reducing the injectivity of injection wells due to increased viscosity of the solution and, accordingly, low rates of development of deposits, the method is advisable to use when the permeability of reservoir rocks is significant - more than 0.1 μm^2. Deposits with a relatively homogeneous structure of productive strata, predominantly of the pore type, are favorable [10; 310–311-p.].

Conclusions.

When a solution is filtered in a porous rock medium, the polymer is adsorbed on the walls of the voids. The intensity of this process is especially noticeable when the first portion of solution moves in the formation, when the formations are significantly watered with

mineralized water as a result of previous development, and when the reservoir rocks are highly clayey [10, p. 275]. At the same time, it is believed that the method can be most effectively applied to new deposits (with low water saturation of the formations) with low clay content of the reservoirs (no more than 8-10%). Due to the loss of the ability of polymers to thicken water at high temperatures, it is advisable to use the method at a formation temperature of no higher than 70-90 °C. The permissible depth of productive deposits is determined by the pressure loss due to friction of the viscous fluid in injection wells and the magnitude of the geothermal gradient.

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Article / Original Paper

HISTORY AND DEVELOPMENT OF AUTOMATED CONTROL SYSTEMS

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Abstract. This article examines the history and development of automated control systems from the first mechanical devices to modern digital systems. The evolution of the main technologies and concepts that influenced the integration of information technologies, the development of network solutions, and the development and improvement of automated control systems was studied. The stages of development of automated control systems are analyzed: from primary automation systems in industry to modern integrated control systems in various industries. The article also discusses the problems and problems associated with the safety and reliability of automated control systems and discusses ways to overcome them.
Key words: automated control systems, history of automation, digitalization, information technology, enterprise automation, network solutions, security of control systems, reliability of control systems.

AVTOMATLASHTIRILGAN BOSHQARUV TIZIMLARINING TARIXI VA RIVOJLANISHI

Xidirova Noila Boymurotovna
Iqtisodiyot va Pedagogika universiteti, “Kompyuter tizimlari” kafedrasi o’qituvchisi

Annotatsiya. Ushbu maqolada birinchi mexanik qurilmalardan tortib zamonaviy raqamli tizimlargacha bo'lgan avtomatlashtirilgan boshqaruv tizimlari tarixi va rivojlanishi ko'rib chiqiladi. Axborot texnologiyalari integratsiyasi, tarmoq yechimlarini ishlab chiqish, avtomatlashtirilgan boshqaruv tizimlarini ishlab chiqish va takomillashtirishga ta’sir ko‘rsatgan asosiy texnologiyalar va tushunchalar evolyutsiyasi o‘rganildi. Sanoatdagi birlamchi avtomatlashtirish tizimlaridan tortib turli tarmoqlardagi zamonaviy integral boshqaruv tizimlarigacha bo‘lgan avtomatlashtirilgan boshqaruv tizimlarining rivojlanish bosqichlari tahlil qilingan. Maqolada, shuningdek, avtomatlashtirilgan boshqaruv tizimlarining xavfsizligi va ishonchliligi bilan bog'liq qiyinchiliklar va muammolarga e'tibor qaratilgan va ularni bartaraf etish yo'llari ko'rib chiqildi.
Kalit so‘zlar: avtomatlashtirilgan boshqaruv tizimlari, avtomatlashtirish tarixi, raqamlashtirish, axborot texnologiyalari, korxonalarni avtomatlashtirish, tarmoq yechimlari, boshqaruv tizimlarining xavfsizligi, boshqaruv tizimlarining ishonchliligi.

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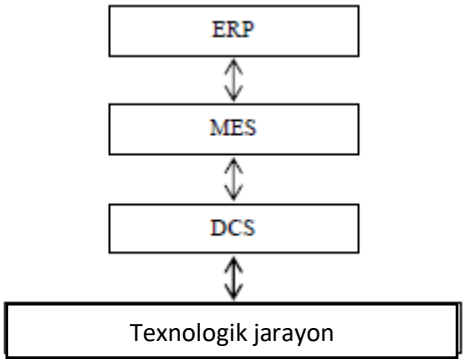
Kirish. Korxonalar faoliyatini rejalashtirish va samarali boshqarish vazifasi avtomatlashtirilgan boshqaruv tizimlari (ABT) asosi bo‘lgan axborot texnologiyalarini qo‘llashning asosiy yo‘nalishlaridan biridir.

Avtomatlashtirilgan boshqaruv tizimini shartli ravishda "korxonani boshqarish" (ERP, MRP darajasi), "ishlab chiqarishni boshqarish" (MES darajasi) va "jarayon va uskunalarni boshqarish" deb ataladigan o'zaro ta'sir darajalarining avtomatlashtirilgan tizimlari to'plami (DCS darajasi) sifatida taqdim etilishi mumkin (1-rasm).

ERP darajasi avtomatlashtirilgan korporativ boshqaruv tizimlari (ACS) tomonidan amalga oshiriladi, DCS darajasi avtomatlashtirilgan jarayonlarni boshqarish tizimlari (APCS) tomonidan amalga oshiriladi va MES darajasining eng muhim funktsiyasi APCS va jarayonni boshqarish tizimi o'rtasidagi interfeysdir. [1]

Insonning boshqaruv tizimida bo'g'in sifatida ajralmas mavjudligini nazarda tutgan "avtomatlashtirilgan boshqaruv tizimi" tushunchasining ma'nosi yo'qoldi. Darhaqiqat, avtomatlashtirilgan boshqaruv tizimlarida hech qachon amalga oshirilmagan korxonalarni boshqarish funktsiyalari bo'lib, ular faqat korxona boshqaruvi bo'yicha qaror qabul qilganlarga ma'lumot beradi, lekin tizimdan tashqarida edi.



1-rasm. Avtomatlashtirilgan boshqaruv tizimining blok diagrammasi

Adabiyotlar tahlili. "Iqtisodiy kibernetika" deb nomlangan yo'nalish doirasida avtomatlashtirilgan boshqaruv tizimlarini yaratish bo'yicha ishlar akademik V.M. Glushkov 1963-1964 yillarda SSSR Fanlar akademiyasining Kibernetika institutida ishlagan.

Sobiq SSSRda yirik ishlab chiqarish korxonalari uchun birinchi tizim Lvovdagi "Elektron" televizion zavodida joriy qilingan "Lvov" avtomatlashtirilgan boshqaruv tizimi edi. [3]

V.M. Glushkov qoldirgan muammoning yechimi - ma'lum bir korxona uchun individual tizimni emas, balki standart tizimni yaratish, standart tizimni ulash, sozlash va amalga oshirishda ma'lum bir korxonaning xususiyatlariga parametrik sozlashdan foydalanadigan amaliy dasturlarni yaratish usullariga olib keldi. Ilova dasturlarini qurishda raqamli qiymatlardan ko'ra parametrlardan maksimal darajada foydalanishning ushbu usullari vaqt o'tishi bilan keng tarqaldi va bugungi kunda ham korporativ resurslarni rejalashtirish (ERP) axborot tizimlarida qo'llaniladi.

V.M. Glushkov doimiy vazifalar oqimi bo'lgan tizimlar uchun mo'ljallangan maxsus operatsion tizim kontseptsiyasi ilgari surildi. 360 mikroprotsessorlar oilasi uchun IBM OS/360 kabi ma'lumotlar markazlarida ommaviy rejimda tasodifiy topshiriqlar oqimini hal qilish uchun umumiy maqsadli operatsion tizimlar avtomatlashtirilgan boshqaruv tizimlarida muntazam topshiriqlar oqimini bilish afzalliklaridan foydalanmadi. Shu sababli, bunday yechimlar Minsk va Ural kompyuterlarining standart operatsion tizimlariga keltirilmagan bo'lsa-da, Minsk va Ural seriyali mahalliy ikkinchi avlod kompyuterlari asosida avtomatlashtirilgan boshqaruv tizimining dasturiy ta'minoti uchun vazifalarni rejalashtirish, ma'lumotlarni oldindan tayyorlash va amaliy dasturlarning ko'p dasturli bajarish rejimlarini boshqarish uchun dasturiy vositalar ishlab chiqilgan.

Hozirgacha korxonalarni avtomatlashtirish uchta alohida va mustaqil yo'nalishda amalga oshirildi: boshqaruv va moliya-xo'jalik faoliyatini avtomatlashtirish tizimlari (ACMS),

kompyuterda loyihalash tizimlari (CAD) va texnologik va ishlab chiqarish jarayonlarini avtomatlashtirish tizimlari (APCS). Ushbu tizimlar korxonalarning turli bo'linmalarining talablari asosida ishlab chiqilgan va yaratilgan, ular umumiy maqsad va vazifalarga bo'ysunmagan, jismoniy va axborot jihatdan yomon bog'langan, har bir tizim o'zining ichki qonunlariga muvofiq qurilgan. Yana bir katta kamchilik shundaki, tizimlar turli apparat, dasturiy ta'minot va axborot standartlariga asoslangan edi.

Hozirgi vaqtda avtomatlashtirilgan boshqaruv tizimlari tushunchasi o'rniga aniqroq tushuncha - korporativ axborot tizimlari (MDH) qo'llaniladi. Ular ishlab chiqarish, moliya, ta'minot va sotish, kadrlar va axborot resurslarini hisobga olish va boshqarishni avtomatlashtirish muammolarini hal qilish uchun tizimlar funktsional ravishda birlashtirilgan tizimlar deb tushuniladi. Asosan taqsimlangan mijoz-server arxitekturasidan foydalangan holda zamonaviy MDHning texnik bazasi mahalliy tarmoqlar orqali ulangan serverlar va foydalanuvchi ish stantsiyalaridan iborat.

Muhokama. Axborot tizimi (AT) - bu quyidagi asosiy elementlarni o'z ichiga olgan barcha axborot va hujjat aylanishini boshqarish jarayonida ishtirok etadigan korxona (tashkilot) ning butun infratuzilmasi:

- axborot modeli, ya'ni AT ning ishlashi uchun qoidalar va algoritmlar yig'indisi. Axborot modeli hujjatlarning barcha shakllarini, ma'lumotnomalar va ma'lumotlarning tuzilishini va boshqalarni o'z ichiga oladi:
- axborot modelini ishlab chiqish qoidalari va unga o‘zgartirishlar kiritish qoidalari;
- konfiguratsiyasi axborot modeli talablariga javob beradigan dasturiy majmua;
- apparat va texnik baza (kompyuterlar, periferik qurilmalar, aloqa kanallari, tizim dasturiy ta'minoti, DBMS). [2]

Axborot tizimini bir necha o'zaro ta'sir qiluvchi ierarxiya darajalaridan tashkil topgan model sifatida ko'rsatish mumkin (2-rasm).

Predmet sohasi ilovasi
Tizimli xizmatlar Internet, e-mail, ma’lumotlar bazasini boshqarish tizimi, guruhli ishlash vositalari
Tarmoq operatsion tizimlari
Transportli tizim: Lokal va global tarmoqlar
Kompyuterlar: Personal, ishchi stansiyalar, serverlar, meymfreymlar, klasterlar

2-rasm. Axborot tizimining ierarxik modeli

Modelning negizida ma'lumotlarni saqlash va qayta ishlash vositalari bo'lgan har xil turdagi EHMlar qatlami joylashgan. Kompyuterlar axborot tizimining apparat platformasini belgilaydi. [6]

Transport tizimi faol va passiv tarmoq qurilmalaridan iborat bo'lib, ular kompyuterlarni mahalliy va global tarmoqlarga bog'laydi va ma'lumotlar almashinuvini ta'minlaydi. Faol tarmoq qurilmalariga kompyuter tarmoq adapterlari va modemlari, hublar, kommutatorlar, marshrutizatorlar va boshqa shu kabi qurilmalar kiradi. Ma'lumotlarni uzatish vositasi va kabel tarmog'i elementlari transport tizimining passiv qismini tashkil qiladi.

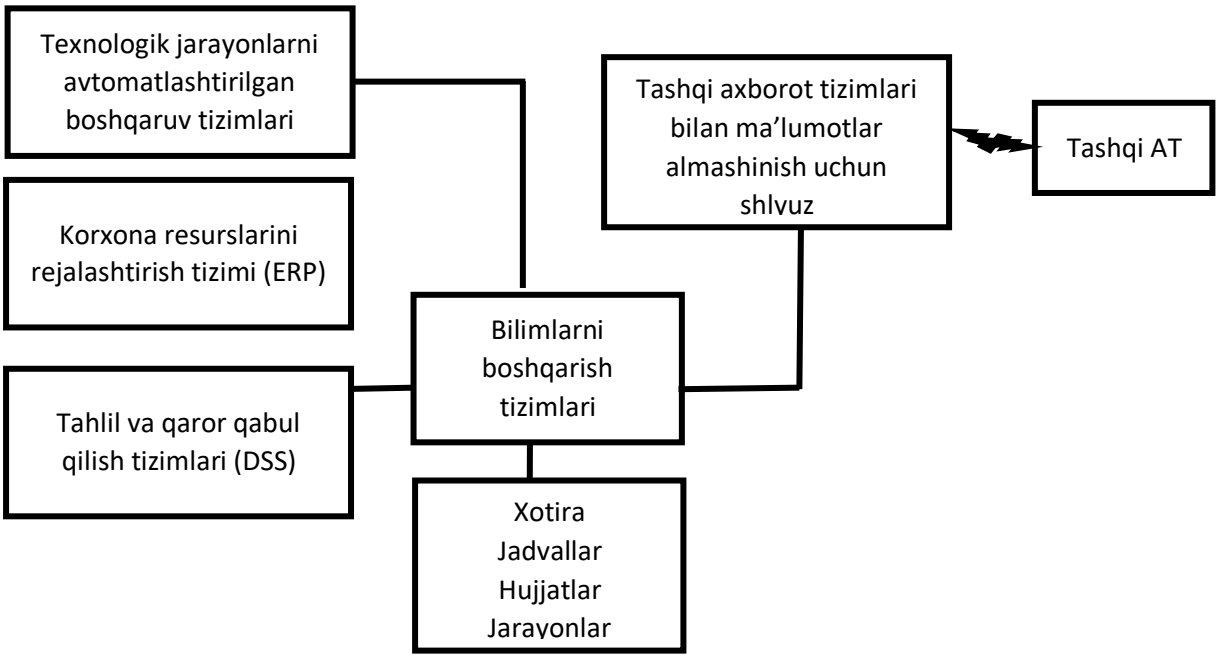
Tarmoq operatsion tizimlari qatlami foydalanuvchi ilovalarining bajarilishini ta'minlaydi va transport tizimi orqali boshqa kompyuterlarning resurslariga kirishni tashkil qiladi va uning resurslarini umumiy foydalanish uchun taqdim etadi. Kompyuter operatsion tizimlari axborot tizimining dasturiy platformasini belgilaydi. Kommutatorlar va marshrutizatorlar kabi bir qator faol tarmoq qurilmalari odatda internetda ishlaydigan operatsion tizimlar deb ataladigan o'zlarining operatsion tizimlarini boshqaradilar. [8]

Operatsion tizimlar qatlamining yuqori qismida turli xil ilovalar qatlamlari joylashgan. Tizim xizmatlari ma'lumotlar bazasini boshqarish tizimlari (DBMS) va boshqa resurslardan olingan ma'lumotlarni oxirgi foydalanuvchi yoki amaliy dastur tomonidan idrok etish uchun qulay shaklga qayta ishlash va o'zgartirish uchun xizmat qiladi. DBMS ba'zan alohida qatlamga bo'linadi. Bu ularning ma'lumotlarni tartibli shaklda saqlash va asosiy qidiruv operatsiyalarini bajarish va kerakli ma'lumotlarni olish vositasi sifatidagi yuqori ahamiyatini ta'kidlaydi.

Axborot tizimining yuqori qatlami ma'lum bir korxona (tashkilot) yoki muayyan turdagi korxona uchun xos bo'lgan domen ilovalaridan iborat. Bular hisob, loyihalash, ishlab chiqarishni boshqarish, bloklar, texnologik jarayonlar va boshqalarni avtomatlashtirish dasturiy ta'minot tizimlari bo'lishi mumkin. [4]

Amaliy dasturlarning ishlashi uchun korxona axborot tizimi yaratiladi. Aynan shu dasturlar xodimlarni qarorlar qabul qilish uchun zarur ma'lumotlar bilan ta'minlaydi va turli xizmatlar faoliyatini avtomatlashtiradi. Shuning uchun axborot tizimini loyihalashda avvalo ushbu dasturlarga qo'yiladigan talablar aniqlanadi va shundan keyingina ularning samarali ishlashi uchun qanday tizim xizmatlari, ma'lumotlar bazalari, operatsion tizimlar, tarmoq vositalari, kompyuterlar va serverlar zarurligi aniqlanadi. [9]

Dasturiy ta'minot texnologiyalari nuqtai nazaridan, axborot tizimi bir yoki hatto bir nechta dasturiy tizimlar emas. Axborot tizimining tarkibiy modelini uning asosiy komponentlarini ajratib ko'rsatish orqali qurish mumkin, ularda ma'lum bir sinfning dasturiy modullari mavjud (3-rasm).



3-rasm. Axborot tizimining tarkibiy modeli

Axborot tizimining eng quyi darajasi korxonaning barcha intellektual mulklarini o'z ichiga olgan ombordir. Bu hujjatlar, ma'lumotnomalar, tuzilma jadvallari, biznes qoidalari, jarayon tavsiflari bo'lishi mumkin. Foydalanuvchilar uchun ham, turli korporativ tizimlar uchun ham saqlashga to'g'ridan-to'g'ri kirish imkoni bo'lmasligi kerak. Faqat bilimlarni boshqarish tizimi to'g'ridan-to'g'ri kirish huquqiga ega, bu boshqa tizimlar uchun o'ziga xos shlyuz bo'lib xizmat qiladi va korxonaning axborot muhitini shakllantiradi. Bilimlarni boshqarish tizimi g'oyalar, bilimlar, hujjatlar mazmuni va biznes qoidalarini birlashtiradi, korxona ichida ham, turli tashkilotlar o'rtasida ham bilimga asoslangan jarayonlarni avtomatlashtiradi. Buning uchun sizga tashqi tizimlar bilan ma'lumot almashish imkonini beruvchi shlyuz kerak. Bu zaruriy shart, chunki zamonaviy jarayonlar korxonalarni korporatsiyalarga birlashtirishga qaratilgan va bilimlarni uzatish juda muhimligi aniq. Masalan, korxona resurslarini rejalashtirish tizimlari (ERP) mustaqil ravishda ishlay olmaydi - moliyaviy menejment, omborlar va inson resurslari bilan bog'liq jarayonlar allaqachon to'plangan bilimlardan foydalanadi va yangilarini olib keladi. [7]

Shuningdek, tahlil va qaror qabul qilish tizimlari sinfini ajratib ko'rsatish muhimdir (DSS), ularsiz axborotning hayot aylanishi tugamaydi. Zamonaviy korxonalarda ma'lumotlarni yig'ish tobora muhim vazifaga aylanib bormoqda. Bu saqlash joylarida to'plangan katta hajmdagi ma'lumotlarni tahliliy qayta ishlash zarurati bilan bog'liq. Bunday tizimlar yangi bilimlarni topishga, axborot tizimining kamchiliklari va zaif tomonlarini aniqlashga, muayyan jarayonlarning samaradorligini baholashga va yangi axborot munosabatlarini o'rnatishga yordam beradi.

Ko'pincha bu toifadagi tizimlar to'g'ridan-to'g'ri saqlash bilan ishlashi kerakligi aytiladi, chunki undagi ma'lumotlar qayta ishlanishi kerak. Bu nazariy jihatdan to'g'ri, lekin amalda bu mumkin emas - ma'lumotlar ombori tarkibidagi, jarayonlar, qoidalar va munosabatlardagi har qanday o'zgarishlar bilimlarni boshqarish tizimi tomonidan amalga oshirilishi mumkin va amalga oshirilishi kerak. Shunda DSS tizimlari ma'lumotlar saqlanadigan format haqida

o'ylamasligi kerak va eng muhimi, ma'lumotlarning har qanday o'zgarishi darhol u ishtirok etadigan munosabatlar va jarayonlarga ta'sir qiladi. [10]

Natijalar. Tizimning funktsional to'liqligi. Barcha dasturiy ta'minot ishlab chiqaruvchilarining mavzu sohasini va yaratilgan ilovalarning nomini tuzilishga bo'lgan uslubiy yondashuvlari har xil ekanligini hisobga olsak, korporativ axborot tizimining funktsional to'liqligining umumiy xarakteristikasi korxona faoliyatining hisobga olinadigan parametrlari sonidir. bir marta hisob. MDH uchun ushbu parametrlarning qiymati taxminan quyidagicha bo'lishi kerak deb ishoniladi:

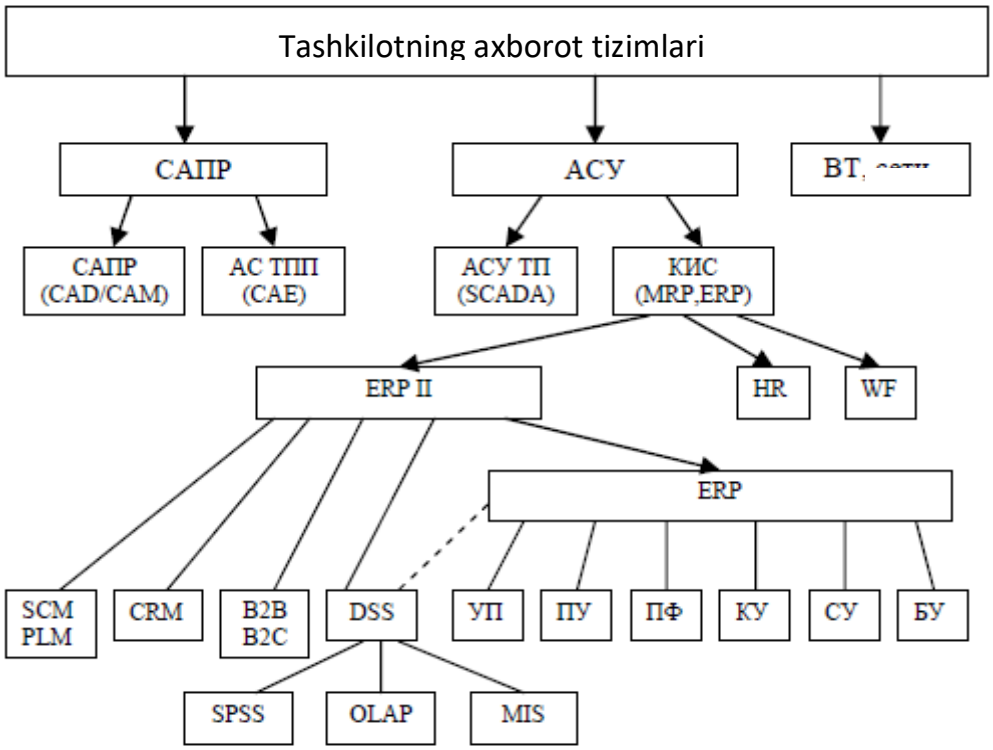
- hisobga olingan parametrlar soni 2 – 10 ming;
- ma'lumotlar bazasi jadvallari soni 800 – 3000.

Axborot tizimini mahalliylashtirish zaruriy shart: milliy qonunchilik va to'lov tizimini hisobga olgan holda; milliy tilda interfeys va yordam tizimi. Tizim ma'lumotlar va funktsiyalarga kirishning farqlanishini ta'minlashi va ma'lumotlarga ruxsatsiz kirishga urinishlarning oldini olishi kerak. [11]

MDH tashqi omillarning ta'siri (masalan, qonun hujjatlarining doimiy o'zgarishi) va korxonaning biznes funktsiyalarining o'zgarishi tufayli doimiy rivojlanayotgan tizimdir, shuning uchun tizimni moslashtirish va saqlash uchun vositalarga ega bo'lish zarur:

- biznes-jarayonlarning tuzilishi va funksiyalarini boshqarish;
- axborot maydonini o'zgartirish (ma'lumotlar bazasini tahrirlash, strukturani, jadval maydonlarini, aloqalarni, indekslarni va boshqalarni o'zgartirish);
- ma'lumotlarni kiritish, ko'rish va tuzatish uchun interfeyslarni o'zgartirish;
- foydalanuvchi ish joyining tashkiliy-funksional tarkibidagi o‘zgarishlar;
- shaxsiy hisobotlarni, murakkab biznes operatsiyalari va shakllarini yaratish.

MDH murakkab tizim bo'lib, uning ishonchliligini ta'minlash uchun ish paytida tizimning holatini tahlil qilish uchun maxsus vositalar talab qilinadi. Korxona axborot texnologiyalarining umumlashtirilgan tuzilishi 4-rasmda keltirilgan.



4-rasm. IT korxonasining umumiy tuzilmasi

Ba'zi ekspertlar korporativ axborot tizimini yaratishga sarmoya kiritishni uzoq muddatli investitsiyalar deb hisoblashadi va ishlab chiquvchi tomonidan ko'rsatiladigan xizmat darajasi va sifati katta ahamiyatga ega. Mijoz uchun eng maqbul holat - u bitta etkazib beruvchi bilan bog'lanib barcha xizmatlarni oladi. [12]

Xulosa. Avtomatlashtirilgan boshqaruv tizimlarini (ACS) rivojlantirish eng oddiy mexanik qurilmalardan raqamli texnologiyalar va sun'iy intellektga asoslangan zamonaviy yuqori texnologiyali tizimlargacha bo'lgan uzoq va qiziqarli yo'lni bosib o'tdi. Avtomatlashtirilgan boshqaruv tizimlarining evolyutsiyasi insoniyatning turli sohalarda boshqaruv jarayonlarining samaradorligi, ishonchliligi va xavfsizligini oshirish istagini aks ettiradi. Bu yo‘lda muhim bosqichlar axborot texnologiyalarining joriy etilishi, tarmoq yechimlari ishlab chiqilishi va sun’iy intellektning integratsiyasi bo‘ldi, bu esa yanada aqlli va moslashuvchan tizimlarni yaratish imkonini berdi.

Zamonaviy avtomatlashtirilgan boshqaruv tizimlari sanoat ishlab chiqarishi, transport tizimlari, energetika, tibbiyot va boshqa ko'plab sohalarning ajralmas qismiga aylandi. Ular mehnat unumdorligini sezilarli darajada oshirdi, tannarxni kamaytirdi, mahsulot va xizmatlar sifatini yaxshiladi. Narsalar Interneti (IoT) ning joriy etilishi va kiber-fizik tizimlarning rivojlanishi avtomatlashtirilgan boshqaruv tizimlarini yanada takomillashtirish uchun yangi ufqlarni ochib, yanada moslashuvchan va moslashuvchan echimlarni yaratish imkoniyatini berdi.

Biroq, avtomatlashtirilgan boshqaruv tizimlarining rivojlanishi bilan ushbu tizimlarning xavfsizligi va ishonchliligi bilan bog'liq yangi muammolar paydo bo'ladi. Kiberxavfsizlik tahdidlari, tarkibiy qismlarning murakkabligi va o'zaro bog'liqligi doimiy e'tiborni va himoya qilish va xavflarni boshqarishga yangi yondashuvlarni ishlab chiqishni talab qiladi.

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SOFTWARE FOR EVALUATION OF THE STATE OF A DYNAMIC CONTROL OBJECT

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Annotation: The article presents software for dynamic control of the assessment of the state of an object. A functional diagram of an adaptive system for dynamic control of technological processes is proposed. When considering the issue of automation, control or simulation of dynamic control objects, it is necessary first of all to consider the process as a control object. This allows the use of these algorithms in the automation and control of dynamic production objects.
Keywords: Software, technology, adaptive filters, automation of dynamic control objects, object-oriented programming languages, dynamic objects, regularization parameter, control effect, iterative regularization principle, mathematical model, noise estimation.

DINAMIK BOSHQARISH OBYEKTLAR HOLATINI BAHOLASH MASALALARINING DASTURIY TA'MINOTI

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Annotatsiya: Maqolada dinamik boshqarish obyektlar holatini baholash masalalarining dasturiy ta'minoti keltirilgan. Dinamik jarayonni boshqarishning adaptiv tizimini funksional sxemasi taklif etilgan. Dinamik boshqarish obyektlarini avtomatlashtirish, boshqarish yoki modellashtirish masalasi ko'rilayotganda avvalo jarayonni boshqaruv obyekti sifatida ko'rish chiqish lozim. Keltirilgan algoritmlar orqali ishlab chiqarishlarining dinamik obyektlarini avtomatlashtirish va boshqarish masalalarida qo'llash imkonini beradi.
Kalit so'zlar: Dasturiy ta'minoti, texnologiya, adaptiv filtrlar, dinamik boshqarish obyektlarini avtomatlashtirish, Obyektga yo'naltirilgan dasturlash tillari, dinamik obyektlar, muntazamlash parametri, boshqaruvchi ta'sir, iterativ muntazamlashtirish prinsipi, matematik model, shovqin bahosi.

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Kirish. Zamonaviy ishlab chiqarishning o'sishi hamda texnika-texnologiyalarning shiddat bilan rivojlanishi dinamik obyektlarning holatini muntazam ravishda baholashni talab qiladi. Shu bilan birga boshqaruv tizimlarini dasturiy ta'minotida ham nazoratni olib borishni taqoza etadi. Ishlab chiqarishda obyekt tavsiflari va tashqi muhit ta'sirlariga nisbatan aprior va joriy axborotning to'liq bo'lmagan sharoitlarida, ya'ni noaniqlik sharoitida texnologik jarayonlarni boshqarishni amalga oshirish imkonini beradi. Shu bilan birga, aprior noaniqlikning paydo bo'lishi avtomatlashtirilayotgan obyekt va jarayonlarning modellarini shakllantirish bosqichidayoq yuz beradi. Joriy noaniqlik nazorat qilinmaydigan tasodifiy xarakterda bo'lib, bu meyoriy foydalanish rejimida obyektga tashqi muhitning ta'siri va boshqarish obyektining statik va dinamik xossalari o'zgarishi bilan belgilanadi. [2]

Muhokama. Dinamik boshqarish obyektlarini avtomatlashtirish, boshqarish yoki modellashtirish masalasi ko‘rilayotganda avvalo jarayonni boshqaruv obyekti sifatida ko‘rish chiqish lozim. Masalan, kompyuter tizimlari va dasturlarini loyihalash jarayonlarini boshqaruv obyekti sifatida ko‘rib chiqamiz. Agar ko‘rib chiqilayotgan masaladagi haqiqiy jarayonni yetarlicha aniqlik bilan matematik munosabatlar orqali ifodalash mumkin bo‘lsa, bu masalani matematik model qurish yordamida yechish mumkin bo‘ladi. [4,6]. Obyekt deganda har xil xossa va xususiyatlarga ega bo‘lgan hamda biror soha jarayonini ifoda etuvchi, tabiatning biror elementi tushuniladi. Obyektni o‘rganish o‘ta murakkab jarayon bo‘lib, u bir necha xil usul yordamida amalga oshiriladi. Shu bilan birga obyektni o‘rganish shu soha mutaxassisidan yetarlicha bilim va ko‘nikmalarni talab etadi.Dinamik boshqarish obyektlar holatini baholash masalalarining dasturiy ta’minoti ishlab chiqish uchun dastlab «Obyektga yo‘naltirilgan dasturlash texnologiyalari” hamda “Obyektga yo‘naltirilgan dasturlash tillari” ga to‘xtalib o‘tamiz.Texnologiya (grek. techne – san’at, hunar, uddalash va logos – bilimlar) so‘zining lug‘aviy ma’nosiga qaraymiz. Unga ko‘ra, “Texnologiya – mahsulot ishlab chiqarish jarayonida xomashyo, material yoki polufabrikatga ishlov berish, tayyorlash, ularning holati, xossalari va shaklini o‘zgartirish majmui. Ishlab chiqarish jarayonining tarkibiy qismi bo‘lgan amallar ham texnologiyaga kiradi. Texnologiyaga ishlab chiqarish jarayonlarini bayon qilish, ularni bajarish bo‘yicha ko‘rsatmalar, texnik qoidalar, talablar va boshqalar ham kiradi”. “Jarayon-qandaydir natijaga erishish uchun bajariladigan harakatlar (amallar) majmui”. Texnologiyaning yana bir ta’rifini ko‘raylik. “Texnologiya - materiallarni (ma’lumotlarni) qayta ishlash vositalari va usullaridir”. [7]

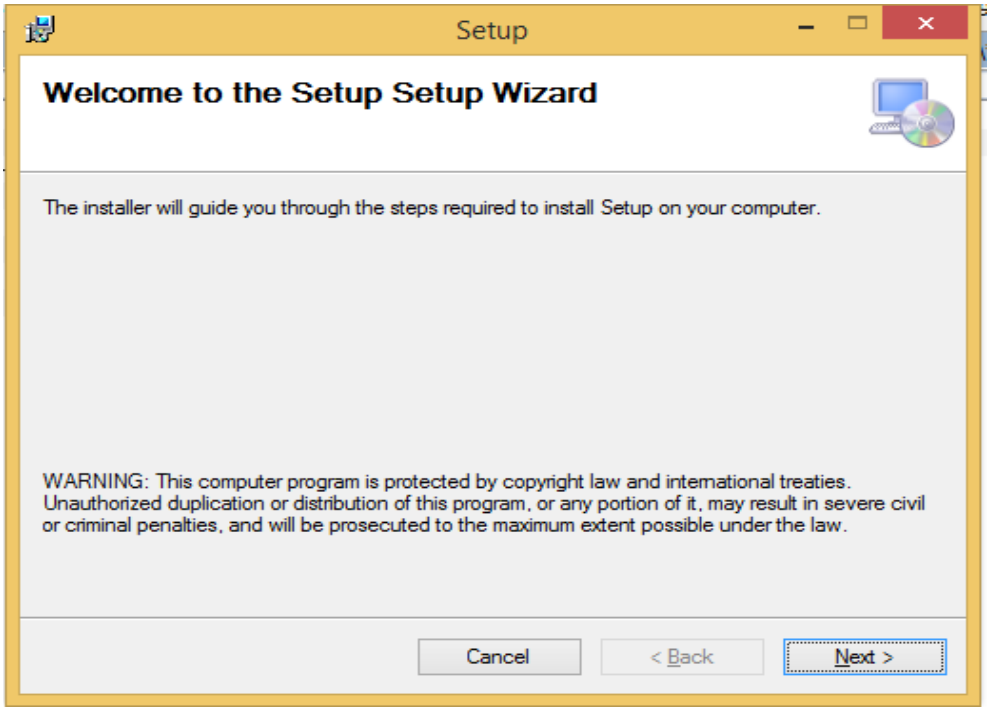
Obyektga yo‘naltirilgan dasturlash tillarining texnologiya bo‘la olishini tekshiraylik. Birinchidan, u berilgan ma’lumotlardan kutilgan ma’lumotlarni hosil qilishni kafolatlaydi, ya’ni ma’lumotlarni bir turdan ikkinchi turga aylantiradi. Ikkinchidan, o‘z ichida turli texnologiyalardan (SQL-texnologiyalari, axborot va internet texnologiyalari, tarmoqlarning server-mijoz texnologiyalari kabi) foydalanadi. Demak, obyektga yo‘naltirilgan dasturlash tillari texnologiya bo‘la oladi. [1] Ammo obyektga yo‘naltirilgan dasturlash texnologiyalari o‘z ichiga obyektga yo‘naltirilgan dasturlash tillarini ham olgani uchun, umumiyroq tushuncha deb qaraladi. Shuning uchun biz ham umumiy holda so‘z yuritganimizda obyektga yo‘naltirilgan dasturlash texnologiyalari, hususiy holda esa tillar tushunchasidan foydalanamiz. Obyektga yo‘naltirilgan dasturlash tili – o‘zaro aloqada bo‘lgan obyektlar majmuasi bilan ish olib boradigan dasturiy tizim bo‘lib, eng asosiy tushunchalari quyidagilar: obyekt, sinf, inkapsulyatsiya, polimorfizm, vorislik. Obyektga yo‘naltirilgan dasturlar tuzilmasining asosiy elementi mantiqan bir-biri bilan bog‘langan obyektlardan tarkib topgan moduldan iborat. G. Buchning ta’rifi bo‘yicha: “OYDT – bu dasturlarni har biri ma’lum bir sinfga oid bo‘lgan obyektlar to‘plami ko‘rinishida ifodalash metodologiyasi. Sinflar esa vorislik prinsipiga asoslangan shajaralarni tashkil qiladi” [8-3].

Natijalar. Hozirgi kunga kelib, bir qator obyektga yo‘naltirilgan dasturlash tillarini ishlab chiqilgan va amaliyotda keng qo‘llaniladi. Ular orasida VISUAL BASIC, DEPLHI, JAVA, C++ kabi dasturlash tillarini alohida tilga olish mumkin. Bu tillarning har birini yechilayotgan masala xarakteriga qarab tanlab olish va amalda qo‘llash mumkin. [5-9]

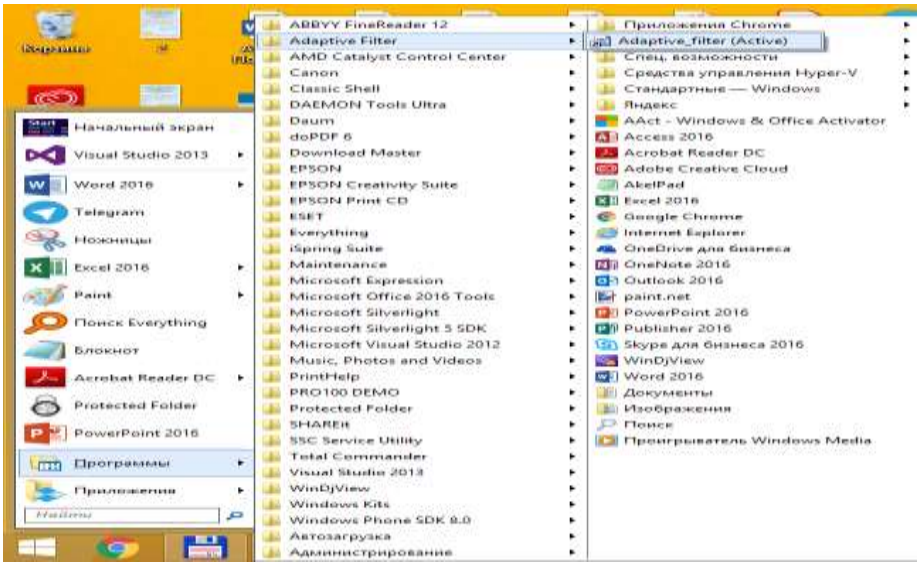
Ushbu maqolada quyilgan masalani yechish uchun, ya’ni dinamik boshqarish obyektlar holatini baholash masalalarining dasturiy ta’minoti ishlab chiqish uchun obyektga yo‘naltirilgan dasturlash tillarini ichidan tushunarli interfeysga ega bo‘lgan Visual Studio

S#.Net Framework 4.5 va Matlab 2016 dasturlash tillarini tanladik. Ishlab chiqilgan dinamik boshqarish obyektlar holatini baholash masalalarining dasturiy ta’minoti bo‘yicha quyidagi tavsiflarni keltiramiz: [10]

Tizimlarni identifikatsiyalash uchun adaptiv filtrlarni qo‘llash algoritmlaridan foydalanib yaratilgan dasturni kompyuterga o‘rnatish yo‘riqnomasi 1-rasmga keltirilgan:



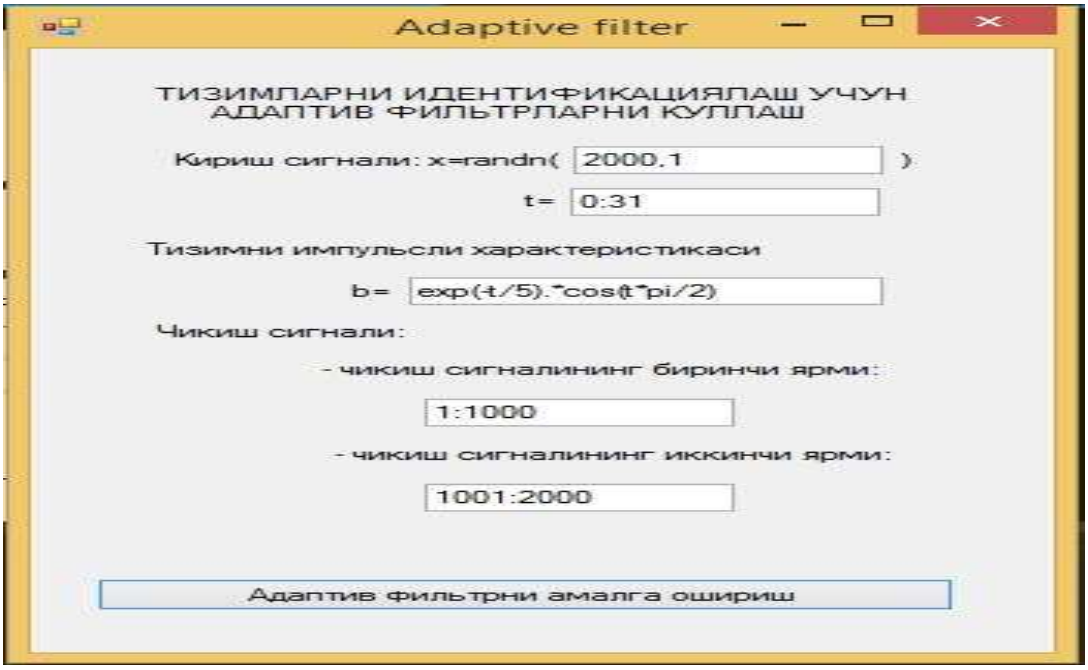
1-rasm. f:\ Shahlo Zaripova\Setup\Debug\setup.exe faylini ishga tushirish.



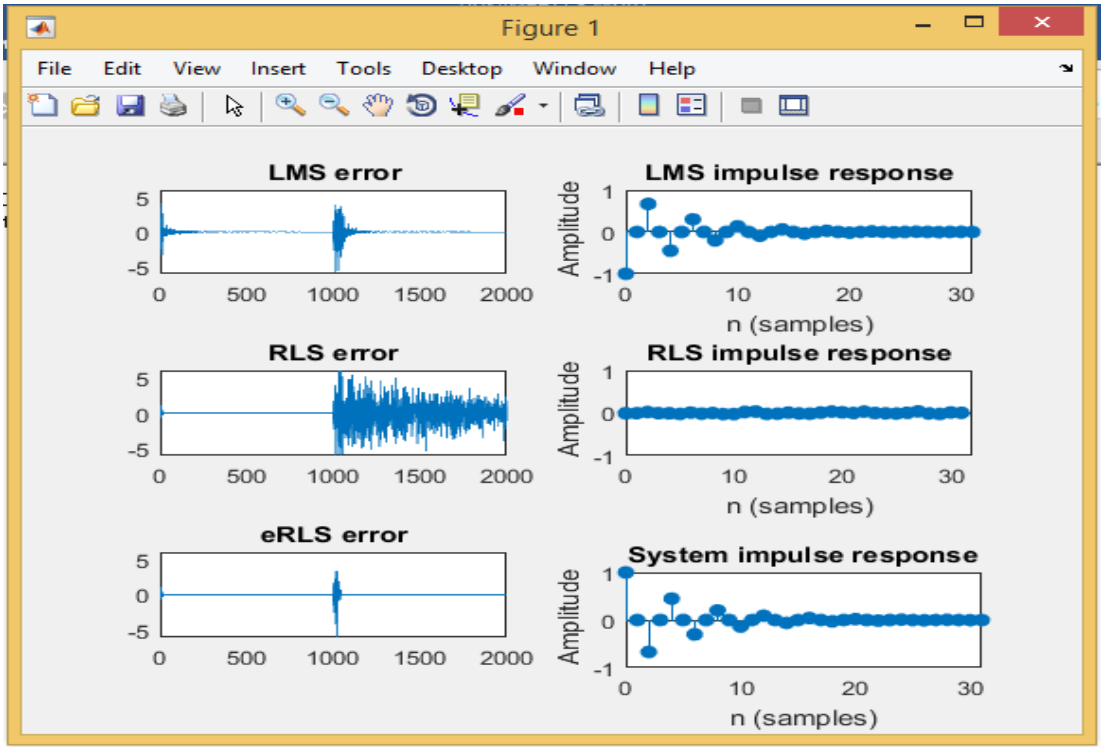
2-rasm. Dastur kompyuterga o‘rnatilgandan so‘ng uni ishga tushirish jarayoni.

Quyidagi ko‘rinishdagi darcha yuklanadi. Bunda foydalanuvchi identifikatsiyalanayotgan tizimning kirish va chiqish signallari shakllantiradi (ya’ni, tasodifiy sonlar oqimi orqali). 2-rasmda tizimning impulsli xarakteristikasi ixtiyoriy ko‘rinishda tanlash mumkin.

3-rasmda “Realizatsiya adaptivnix filtrov” tugmasi bosilganidan so‘ng dastur yuklanadi va barcha ma’lumot kiritish kataklari nofaol rejimga o‘tib dasturda «Iltimos kuting, dastur yuklanmoqda» degan yozuv hosil bo‘ladi:



3-rasm. Dastur ishga tushgandan so‘ng tizimning impulsli xarakteristikasi ixtiyoriy ko‘rinishda tanlash



4-rasm. Dastur ishlagandan so‘ng uning natijasi

Ushbu dastur Visual Studio va Matlab dasturlarining o‘zaro bog‘lanishlaridan foydalanib yaratilgan bo‘lib, u Matlab dasturi to‘liq bilmaydiganlar uchun katta qulaylik tug‘diradi. 4-

rasmda kirish va chiqish signallari, vaqt va tizimni impulsli xarakteristikalarini ixtiyoriy o‘zgartirish natijasida ushbu dasturdan istalgancha foydalanish mumkin.

Xulosa. Keltirilgan dinamik boshqarish obyektlarini avtomatlashtirish, boshqarish yoki modellashtirish masalasi ko‘rilayotganda avvalo jarayonni boshqaruv obyekti sifatida ko‘rish chiqish lozim. Xulosa qilib aytadigan bo‘lsak, dinamik boshqarish obyektlarida kompyuter tizimlari va dasturlarini loyihalash ko‘rib chiqilgan. Adaptiv filtrlash algoritmlari asosida keltirilgan adaptiv filtrlashning kompyuterli modellari baholash va boshqarish masalalarini sintezlash imkonini beradi hamda dinamik jarayonning ma’lumotlarini adaptiv filtrlash algoritmlarini ishlab chiqarish jarayonlarini avtomatlashtirish sohalarida ham yanada kengroq foydalanish mumkin.

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