

# ENGINEERING DEVELOPMENT OF TELESCOPE CONTROL SYSTEMS

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**ABSTRACT.** Advantages are presented in the use of stepping motors with electron drives, developments and investigations of them at the Observatory throughout recent years.

**Key words:** Telescope control systems.

For the first time the urgency of producing new telescope control systems in Odessa arose due to the problem of changing outdated, worn-out by long-term exploitation, counter-weight driven clock mechanisms equipped with centrifugal stabilizers of rotation frequency. These gradually went out of service and their replacement was wanted. Instruments synchronously motor operated owing to a small rate adjustment range in using frequency stabilization circuit designs were not efficient enough.

The development of modern control systems for telescopes manufactured at common tendency of enhanced requirements to stability and precision in rates of wide range led to the development of drives with stepping execution motors [SH] in Odessa.

Many years' use of step drives has shown their high reliability and good exploitation parameters. The elaborated circuit designs and designs have found a wide use not only as clock guiding systems for telescopes but also in other information-measuring devices where precision displacements by rotating are wanted.

The stepping drive as an executive element involved in modern automatic systems is most successfully combined with a control computer.

These properties of the stepping electrodrive have caused its wide application in telescope control systems in astroinstrument making. Moreover, SM are distinguished with steady work, though at different disturbing factors affecting, and with wide frequency range without any power or synchronism loss. By its nature, SM are multiphase synchronous motors retaining synchronism both at the start, reversal, braking and at the zero frequency of rotation permitting lengthy fixed rotor outage. Most adequate in their parameters, which we could afford to purchase were the motors of the types: SM-4M, SM-300/300, SM-200, SM-5 and SM-88.

For selecting optimum designs in the Odessa observatory were developed and investigated drives with all the above types of motors for telescopes at different mountings. To increase the electromagnetic moment at the high frequency motor work the circuit designs were elaborated cutting the duration of transitional processes in control winding, circuits of forcing, circuits of splitting the main rotor step of the motor into several tacts (A.V.Ryabov, O.Sh.Shakhrukhanov).

In developments depending upon the customer's requirements the functional parameters of control systems were set. Small telescopes with mirrors up to 400 mm in diameter were equipped with drives which provided only clock guiding from the right ascension with correcting rates frequency.

For larger telescopes control system functions were broadened. The control from two coordinates with preset rates and fast readjustment to the set angles relative to the observed object was designated. One of the telescopes was equipped with a tracking synchro system.

The development of new methods of telescope control with the help of step electrodrives led to the necessity of producing new original structural and principal circuit designs to realize these methods. Stabilized frequency oscillators, digital dividers of pulse of program control and communication with the computer have been developed (V.N.Ivanov, A.V.Ryabov, O.Sh.Shakhrukhanov). The circuit designs of controllers for direct electrodrive control with the personal computer have been elaborated (A.V.Ryabov). A digital automatic telescope control system with pulse sensors of angular displacements is produced (V.N.Ivanov).

One of designs was awarded a Golden Medal of VDNKH (All-Union Achievements of National Economy) of the USSR in 1985. In the designing of new control systems participated Observatory collaborators, and namely: M.G.Arhipov, V.N.Ivanov, L.I.Keir, A.F.Pereversentsev, A.V.Ryabov, O.Sh.Shakhrukhanov and others. In manufacturing the drives, the Experimental Enterprise of the Main Astronomical Observatory of the Ukraine took part (I.I.Krishchuk, V.V.Kulibaba, R.A.Chaichuk).