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# INTEGRATION OF MICRO ROBOTISED STRUCTURES WITH LARGE RANGE ROBOT.

**V. Kotev[1], P. Genova[2], T. Tiankov[1], K. Kostadinov[1]**
**Institute of Mechanics – BAS, Acad. G. Bonchev Str, bl. 4, 1113 Sofia, Bulgaria**
**Central laboratory of mechatronics and Instrumentation – BAS, Acad. G. Bonchev Str, bl. 1, 1113 Sofia**
**kotev@imbm.bas.bg, pgen@tu-sofia.bg, tihomir@imbm.bas.bg, kostadinov@imbm.bas.bg**

## Abstract
The macro-robot can serve spaces bigger than itself, or commensurable to its dimensions. The work space of the micro-robot is incommensurately smaller than the space it occupies. The co-operation of the two types of robots is necessary when the manipulated object has to be handled into a macro-space and a precise finishing operation has to be carried out in a micro-zone. In this paper we study a 5-link mechanism with a closed kinematic chain (CKC), and incorporated in the links micro actuators for realization of micro and nano motions. The accessible work space of this mechanism is studied both geometrically and kinematically. Some solutions are proposed for its control. Important advantages of hybrid macro-micro mechanical system (MS) are: constructions only with revolute pair; minimal inertia forces due to the light construction – universal actuating devices are fixed, and therefore they faster perform macro operations and last, but not the least, they have a better positioning accuracy than MS with open KC.

**Keywords: macro, micro-robots, actuation, 5 link mechanism.**

## 1.Introduction
Nowadays, it is hard to enumerate the companies and types of produced robots. We will consider one of the latest robots ”SCARA”-RP-AH with structural scheme shown on fig.1. The mechanical system (MS) is with 2 degree of freedom (DoF) realized by a 5-link mechanism ABCD with closed kinematical chains (CKC). Its operative plane is horizontal.

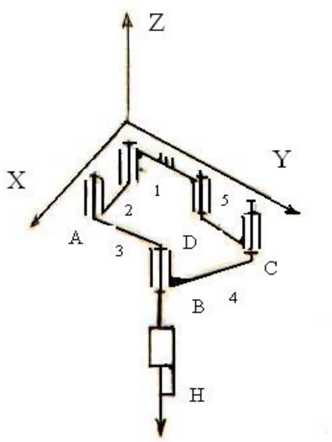


**Fig1. Kinematic scheme of “SCARA” manipulation system**

The end effector H is joined with a translation kinematical pair (KP) along an axis parallel to Oz. A number of papers are dedicated to the geometry, kinematics and optimization of this MS [1, 2]. What is typical about these robots is that they are intended to serve comparatively large working areas, commensurable to their own overall dimensions thus assisting the other machines and humans.
During the continuous science development with robotization of processes realized in the macro-working space, people's interest in micro/nano worlds has been increasing more and more [3, 4]. Conventional approaches of automation, applicable in the macro-world turn to be non-functional for studying micro and nano manipulation processes.
Human skills are insufficient to access freely the micro and nano working space, to operate with micro/nano objects and to perform complex motions influenced by unknown micro/nano properties and dynamics. At the beginning extremely powerful tools for observation in micro and nano range begin to be developed. The scanning and atomic force microscopes are

[1] - Institute of Mechanics – Bulgarian Academy of Sciences (BAS)
[2] - Central laboratory of mechatronics and instrumentation – Bulgarian Academy of Sciences (BAS)

created, enabling human access from micro to atomic level. For the realization of complex teleoperation motions in these spaces,