

Intelligent Structures for Mobile Robots



Fabrication procedures allow a high freedom to print miniaturized sensor elements. The procedures permit a precise shaping on arbitrary substrates with a resolution $> 10 \mu\text{m}$.



CAD drawing of a first concept of an artificial spine. The single elements of the spine are built modularly to allow a serial arrangement of the elements. Wires can run through the center of the spine.

The aim of the iStruct project is the development of a robotic system as well as of biologically inspired structural elements which effectively improve the locomotion and mobility characteristics, if applied to the robotic system. In order to achieve this goal, an improved perception of the environment and the robot's own condition is needed. The intelligent structures to be developed contain a variety of functions which extend the already existing locomotion behaviors of robots and also permit a parallel use as weight carrying and sensing system. This way, different functionalities are realized in one component.

The main focus in this project is the development of intelligent structures for application in mobile robots to increase the efficiency of a complex walking machine by the purposeful use of intelligent structures. In order to achieve this goal, rigid connecting elements are extended to single more flexible subsystems. Concerning mobility and sensor information, such subsystems provide an advantage to the overall system in which they are used. Important sections of the robot have to be protected against impacts and abrupt movements as well as vibrations. The structures will perform absorbing and cushioning functions. In addition, natural appearance and efficient movements can be realized.

For testing and evaluating the intelligent structures, a suitable robot demonstrator will be developed to show the possibilities of these cooperating systems.

If these subsystems are used as carriers and elements of absorption and locomotion, they should be both resi-

lient and flexible. Additionally, the condition of the materials and the structures have to be measurable in order to report the current condition of the overall system to the processing control unit.

A high number of sensors is needed to allow a precise perception of the environment; hence there will be large data sets which have to be locally pre-processed and evaluated. In order to meet the high requirements of the intelligent structures, sensors and actuators have to be selected or developed with regard to both their functionality and their integration capability within the intelligent structures.

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