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BioRob - Biologically Inspired Elastic Robot Arm

MOTIVATION

BioRob is the acronym for a project to develop prototypes of a new robot arm with elastic coupled joints. With an elastic robot arm a lot of new applications in industry, medicine or laboratory automation can be achieved.
The project is realized by the “Technische Universität Darmstadt”, Department of Computer Science (software and control algorithm) and the Ilmenau company TETRA (mechanical design, electronics and sensor systems).
The “Fraunhofer Institut für Biomedizinische Technik IBMT”, Sulzbach is involved to investigate the BioRob arm for the handling of samples in cryonics applications.

The design of the new robot arm is based on a laboratory model with 2 elastic DOF (see Fig. 1) of the biologist Prof. Bernhard Möhl.

The fast growing interest in flexible, versatile and mobile robotic manipulators operating in close vicinity and in direct cooperating with human demands for robots with inherent high passive safety suited for direct human-robot interaction. To gain access to these new applications in the field of automation engineering the “BioRob” project demonstrates the applicability of a new bionic manipulator

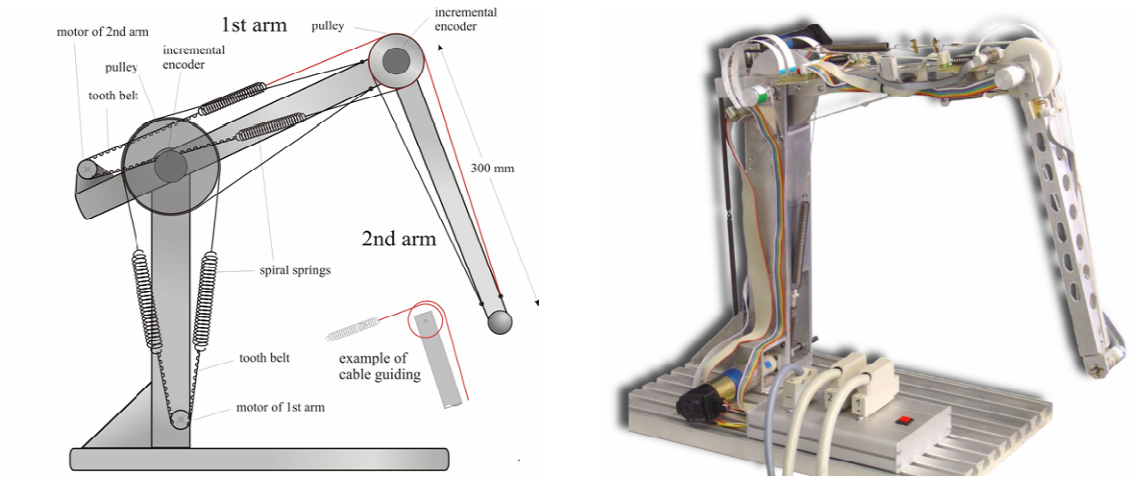

Figure 1: Design principle of the bionic manipulator (left) and laboratory model (right)

TECHNICAL REALISATION

The new manipulator design is more energy efficient and provides higher occupational health and safety properties than conventional rigid manipulators. As a result of the challenges caused by the elastically coupled joints, a new control structure is developed.

The antagonistically bracing construction relieves the arm from bending stress and allows not only a more lightweight construction, but also make sure deformations under load occur only in the elastic part of the drive where they can be measured and not in the link itself.
Furthermore the lengthening of the elastic element can be used to calculate the actual forces acting on the system, which offers new options for a more efficient control.

Figure 2: Design of the new BioRob arm with 4 DOF

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