Parallel Cable Robotics

Best solution for optimizing operations in large spaces

BIG SPACES CHALLENGE

Automation of operations is one of the biggest challenges to optimize operability. Due to limitations such as the reduced workspace of commercial robots, or high cost of large Gantry robots, manipulation over large workspaces is still done with traditional manual cranes.

Parallel cable-driven robotics provides the best cost effective solution, automated and manually controlled, over large or very large workspaces. They are able to position any kind of tooling of another anthropomorphic robot, accurately in a along a wide workspace withstanding external loads just by using cables.

They are:

- **Highly flexible**. They can manage 6 degrees of freedom, or even more if another robotic system is used on the platform.
- **Easily installed**, with no major construction modifications.
- **Highly productive**. Their response time is low and can move around at a high speed.
- **Versatile**, as can be used in complex manipulation tasks in multiple situation (even in aquatic environments) industrial, energy and construction sectors, in automated of manually modes, manipulating heavy payloads over large workspaces.
- **Low maintenance consumers**
- **Low space users**. Columns are placed in corners, and the rest of the system does not need floor space.

TECHNOLOGY

A Cable-Driven Parallel Robot is mainly composed of:

- Winches (motor + encoder + drum)
- Cables
- Pulleys
- Platform (anchoring of cables and tool)
- Controller and drives

The pulleys permit the routing of the cable from the winch to the desired output point. They can be directly fixed on the building or on a dedicated frame.

The lengths of the cables are synchronously controlled in order to provide the desired motion of the platform in the Cartesian space.

The implemented model on the controller takes into account the exact cable routing, sagging and elongation for a better positioning accuracy.
CABLE ROBOTICS APPLICATIONS

MANIPULATION, ASSEMBLING AND MAINTENANCE OF LARGE PARTS AND SYSTEMS

- Manipulation, positioning and assembling of large parts, in a precise way (~2 mm) and with complete control of part orientation (6 dof).
- **Operation mode**: Manual

AUTOMATED LOGISTIC OPERATIONS

- Quick pallet manipulation and storage in automated mode.
- Transport loads up to 500 Kg. with present prototype
- Very high speed
- Can perform unmanned operations
- Collision control and error detection
- **Operation mode**: Automated and manual

INSPECTION AND MAINTENANCE

- Fast movement along large spaces with platforms and/or camera, incorporating specific tooling and repairing materials
- It can perform operations in highly risky confined spaces.
- **Operation mode**: Automated and manual

OPERATIONS ON BIG SURFACES: PAINTING AND WELDING

- Automated painting of large surfaces (planar of curved ones), with maximum accuracy.
- In the same way, other operations as welding large parts are also available.
- **Operation mode**: Automated
FINAL USERS

AIRCRAFT / SHIPYARDS / TRAINS

ENERGY

BUILDING

LOGISTICS

CIVIL ENGINEERING
CoGiRo: Europe Biggest Cable-Driven Parallel Robot

Developed by TECNALIA & CNRS-LIRMM.

- Footprint: 15’11”x11’11” m². Workspace up to 80% of the footprint.
- Payload: 500kg. 4 mm diameter steel cables.
- Industrial controller: B&R Automation.
- Mean positioning accuracy: 20 mm. Mean positioning repeatability: 3mm.
- Crane-like configuration: all its cable drawing points are located above its workspace, gravity being used to keep the cables taut. No cable clutters the lower part of the workspace to avoid cable collisions.
- Robot calibration improved (required to achieve as high accuracy as possible).
- **CoGiRo advanced robot control system** to enable:
  - Manual operation mode via joystick.
  - Direct manipulation of the cables by an operator (“manual manipulation” when the cable is not attached to a payload).
  - Implementation and tuning of another (basic) control scheme to accommodate uncertainties in the payload characteristics.
  - Determination of the cable attachment positions: needed when it is changed the payload (structure element) to which the cables are connected.
  - Cable tensioning procedure: required after having attached the cables to a new payload.

Visiting available at TECNALIA Montpellier (France)

Videos Youtube: Find them writing “COGIRO cable driven parallel robot” at Youtube searcher.