CE150 Helicopter Model

Shows students how to create a controller to control a dynamic, naturally unstable system (a helicopter)

- Compact, bench-top unit for connection to a suitable computer
- Real-time control of a multi-dimensional, naturally unstable system
- Two-input, two-output system with cross-coupling
- Scale-model of a helicopter with main (horizontal) rotor and tail rotor for realistic experience of yaw and pitch control
- Model has adjustable centre of gravity to mimic changes in weight distribution and to test the control system
- System accessible directly from MATLAB®/Simulink environment in real time
- Ideal for classroom demonstrations and student project work
- Includes comprehensive Educational Manual

TecQuipment Ltd, Bonsall Street, Long Eaton, Nottingham NG10 2AN, UK
T +44 115 972 2611 • **F** +44 115 973 1520 • **E** info@tecquipment.com • **W** www.tecquipment.com
An ISO 9001 certified company

TecQuipment

CE150 Helicopter Model

Description

The model simulates a helicopter with horizontal and tail rotors to give pitch and yaw control. Sensors measure the yaw and pitch angles. This gives a two-input and two output system, with cross-coupling. Students use the educational manual (supplied) to help identify plant dynamics and create a control system. The control system must keep the helicopter stable and allow for a change in the centre of gravity. When operating near the steady state, the electromechanical system can be linearized to a six-order model.

The equipment includes:

- The model helicopter on a stand
- An interface unit
- A data acquisition board for your computer
- A protective steel cage to put around the helicopter for safety

The Data Acquisition board fits into a suitable computer (not supplied) to link with the interface and control the motors of the helicopter, and accept inputs from the sensors.

The software (supplied) includes:

- Demonstration program with PID controllers
- Interface library for programming at the system level
- Example Simulink® models for real-time control experiments.

Essential Ancillaries

(Not supplied by TecQuipment)

- Suitable computer with a spare PCIe (PCI Express) slot and Microsoft® Windows® XP, Vista, 7, 8 or 10 operating system. 32-bit and 64-bit.

Note: If you have an older computer with only PCI slots, please contact our sales department.

- Software:
  - MATLAB®
  - Simulink
  - Real-Time Windows® Target
  - Simulink Coder® (recommended)
  - Simulink 3D Animation (recommended)

Standard Features

- Supplied with comprehensive user guide and educational manual
- Five-year warranty
- Made in accordance with the latest European Union directives

Experiments

- Direct derivation of a general mathematical model of a helicopter using Lagrange equations, linearisation and simplification.
- On-line identification of parameters of a linear model. Direct and indirect (closed-loop response analysis) methods should be used.
- System decoupling techniques, diagonalisation of system transfer matrix and state space methods.
- Stabilisation and tracking tasks formulation
- State feedback design, observer design
- Robust and adaptive controller design for changing parameters system due to moving centre of gravity, LQ/LQG and H∞ controller design.
- Comparison of an analogue and digital controller design. Selection of a correct sampling frequency.

Essential Services

Electrical supply:
100 VAC to 240 VAC, 400 W, 50 Hz, with earth

Bench space needed:
1.5 m x 900 mm

Operating Conditions

Operating environment:
Laboratory

Storage temperature range:
–25°C to +55°C (when packed for transport)

Operating temperature range:
+5°C to +40°C

Operating relative humidity range:
80% at temperatures < 31°C decreasing linearly to 50% at 40°C

Sound Levels

Less than 70 dB(A)

Specifications

Helicopter Model Length:
300 mm (without propellers), 370 mm (with propellers)

Helicopter Model Height: 440 mm

Helicopter Model Support: square base 300 x 300 mm
The model is protected by a rigid steel cage, 800 x 800 x 800 mm.

Helicopter Nett weight: 3.5 kg

Interface unit: 480 x 140 x 307 mm, 5.5 kg

Data Acquisition Board: PCIe x1

Approximate packed dimensions and weight:
0.15 m^3 and 15 kg

TecQuipment Ltd, Bonsall Street, Long Eaton, Nottingham NG10 2AN, UK
T +44 115 972 2611 • F +44 115 973 1520 • E info@tecquipment.com • W www.tecquipment.com
An ISO 9001 certified company

TecQuipment