

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
- Supplied with drivers for MATLAB® Real-Time Workshop®
- Ideal for classroom demonstrations and student project work

- TecEquipment 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

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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 software (supplied) with MATLAB® (not supplied) to create a control system. The control system must keep the helicopter stable and allow for a change in the centre of gravity. When in a steady state (vertical angle considered), the system is a linear six-order model.

The equipment includes:

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

The PCI card 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) is a set of interface drivers, supplied with the source code, and drivers for MATLAB® Real-time Workshop.

Standard Features

- Supplied with comprehensive user guide
- Two-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 Ancillaries (not supplied by TecEquipment)

- Suitable computer with a 2 GHz Processor, a spare PCI slot, 1 GB RAM and Microsoft® Windows® 2000, XP or Vista operating system.
- Software:
 - MATLAB®
 - Simulink (essential)
 - Real Time Workshop® (recommended)
 - Real Time Windows® Target (recommended)
 - Open Watcom® C/C++ compiler (recommended)

Essential Services

Electrical supply:

220/240 VAC, 200 W, 50 Hz, with earth

Bench space needed:

1.5 m x 900 mm

Operating Conditions

Operating environment:

Laboratory environment

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:

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

Model support: square base 300 x 300 mm

Height: 440 mm

The model is protected by a rigid steel cage, 800 x 800 x 800 mm.

Nett weight: 3.5 kg

Interface unit:

480 x 140 x 307 mm, 5.5 kg

Total packed dimensions:

0.7 m³ and approximately 15 kg

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