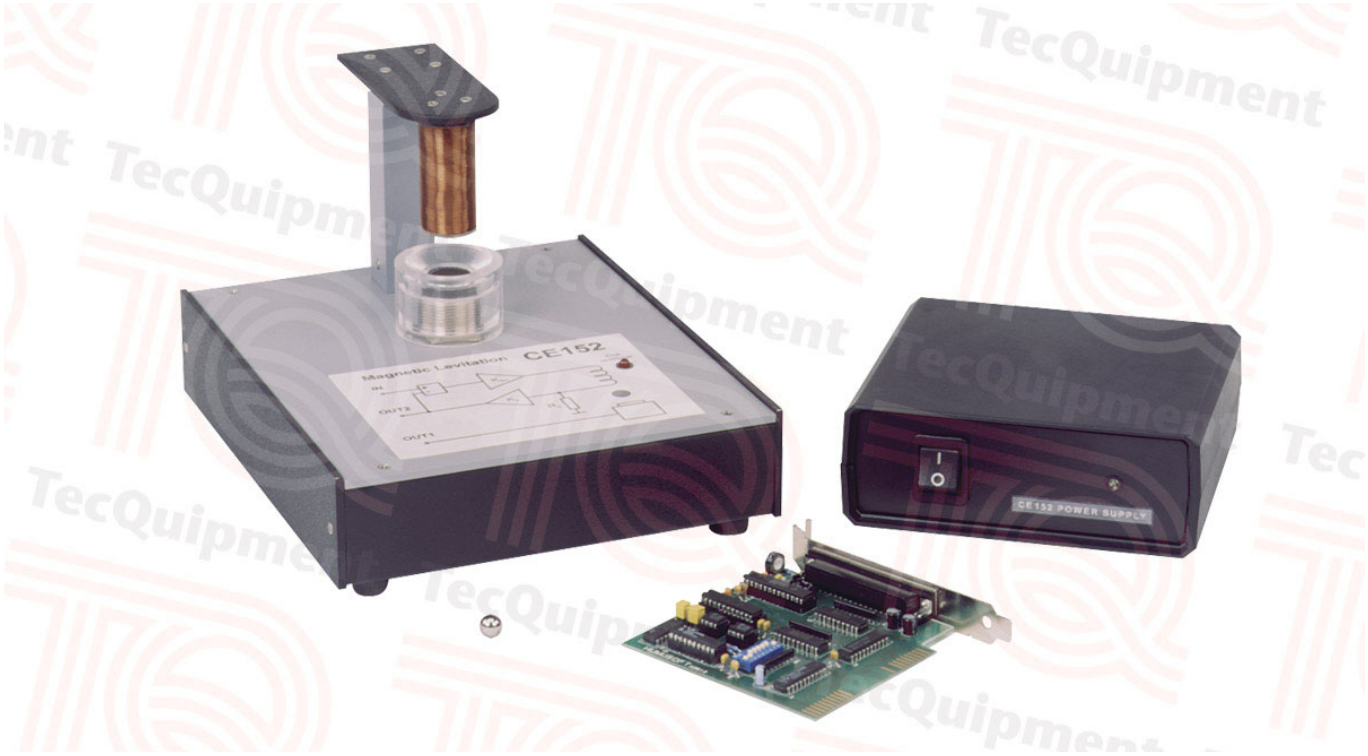
CE152

Magnetic Levitation Apparatus

Shows students how to control a non-linear, unstable system (a steel ball in a magnetic field)



- Compact, benchtop apparatus, ideal for classroom demonstrations and student projects
- Uses a magnetic field to control the vertical position of a steel ball
- Shows the dynamics of a one-dimensional, non-linear, unstable system
- Supports investigations into a number of different control algorithms based on classical and modern control theory – includes PID, LQ/LQC, adaptive, fuzzy and non-linear controller design and operation
- Includes interface libraries (written in C) and demonstration software package with PID controllers
- Hardware module is supplied fully assembled and includes integral power supplies

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CE152 Magnetic Levitation Apparatus

Description

The Magnetic Levitation Apparatus shows control problems with non-linear, unstable systems.

The apparatus consists of a steel ball held in a magnetic field produced by a current-carrying coil.

At equilibrium, the downward force on the ball due to gravity (its weight) is balanced by the upward magnetic force of attraction of the ball towards the coil. Any imbalance and the ball will move away from the set-point position.

The basic control task is to control the vertical position of the freely levitating ball in the magnetic field of the coil.

The Magnetic Levitation Apparatus is a non-linear, dynamic system with one input (set point) and two outputs (ball position and coil current).

A sensor measures the position of the ball. A power amplifier with overheat protection drives the coil.

The equipment includes:

- The ball and coil
- A power supply/interface
- A PCI card for your computer

The PCI card fits into a suitable computer (not included) to link with the interface and control the coil, and accept the signal input from the sensor.

The software (included) 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

Essential Ancillaries (not supplied by TecQuipment)

- Suitable computer with a 2 GHz Pentium processor, a spare PCI slot, 1 GB of RAM and Microsoft® Windows® 2000, XP or Vista operating system.
- Software (not supplied by TecQuipment):
  - MATLAB®
  - Simulink® (essential)
  - Real Time Workshop® (recommended)
  - Real Time Windows® Target (recommended)
  - Open Watcom® C/C++ compiler (recommended)

Experiments

The user guide contains a structured series of experiments that guide the user from system modelling and identification to full non-linear control.

Experiments include:

- Real time digital signal processing
- Digital PID controller design for ball position stabilisation and trajectory tracking
- LQ/LQG controller design based on state and I/O model
- Fuzzy controller design
- Adaptive controller design
- Non-linear controller design

Essential Services

Electrical supply:
110/220 VAC, 50 W, 50/60 Hz, with earth
Specify at time of order

Bench space needed:
500 mm x 800 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

Dimensions and weight:
Magnetic levitation model: 200 x 250 x 175 mm; 2 kg
Power supply: 165 x 140 x 65 mm; 1.5 kg.

Packed dimensions and weight:
0.06 m^3; 22 kg (approx – packed for export)

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