

## Coupled Tanks System

33-041

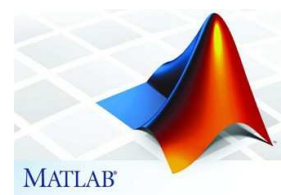
### Description

The Coupled Tanks set-up is a model of a chemical plant fragment. Very often tanks are coupled through pipes and the reactant level and flow has to be controlled. The Coupled Tanks experiment is designed so that the system can be configured.

The Coupled Tanks system has 4 translucent tanks each with a pressure sensor to measure the water level. The couplings between the tanks can be modified by the use of seven manual valves to change the dynamics of the system imposing the use of different controllers. Water is delivered to the tanks by two independently controlled, submersed pumps.

Step disturbances generation is provided by four manual valves. Drain flow rates can be modified using easy-to-change orifice caps. The Coupled Tanks are controlled by using SIMULINK® and an Advantech PCI1711 Interface card. The user may build their own models or use the models supplied together with the curriculum. The process variables can be observed on-screen in plots.

The product is supplied with a student manual that provides information about the physical behaviour of the system models and guides the student through the control tasks. Control algorithms are developed, tested on the models and then implemented in a real-time application.



### Features

- Fully compatible with MATLAB® and SIMULINK®
- Self-contained unit which can be either floor standing (see picture) or bench mounted
- Four tanks each with pressure-sensor water level measurement & easy-to-read visual scale
- Two independently controlled pumps allow variable flow control
- Easy to configure coupling between tanks allows for a wide range of control scenarios from basic to advanced level
- Can be configured as Single Input Single Output (SISO) or Multiple Input Multiple Output (MIMO) system
- System dynamics can be modified using easy to change orifice caps

## Manual Contents

Manual Overview

Introduction

Coupled Tanks set description

Two Coupled Tanks model

Non-linear model testing

Model Linearisation

Linear model

Coupled Tanks model identification

Static characteristic identification

Working point identification

Model identification

Coupled Tanks set-up control

Plant Control

PID Controller

Tank 1 or Tank 2 water level control

PID control of water level in tank 1

Real-time PID control of water level in tank 1

PID control of water level in tank 2

Real-time PID control of water level in tank 2

Two tanks simultaneous control

Real-time simultaneous bottom tanks water level control

Cross-coupled Tanks control

Four coupled tanks model

Cross-coupling influence on the system

Dynamics decoupling

Dynamics decoupling on the model

Cross-coupling paths identification

Dynamics decoupling in real-time

Disturbance compensation

Disturbance compensation on the model

Real-time disturbance compensation with PID control

## Specification

Dimensions & Weight

Coupled Tanks

*Dimensions:*

Floor mounted: 1700 mm x 680 mm x 450 mm

Bench mounted: 1360 mm x 680 mm x 450 mm

Weight (dry): 36 kg

*Reservoir tank capacity:* 32 litres

*Mains supply:* 110 V-240 V 50/60 Hz

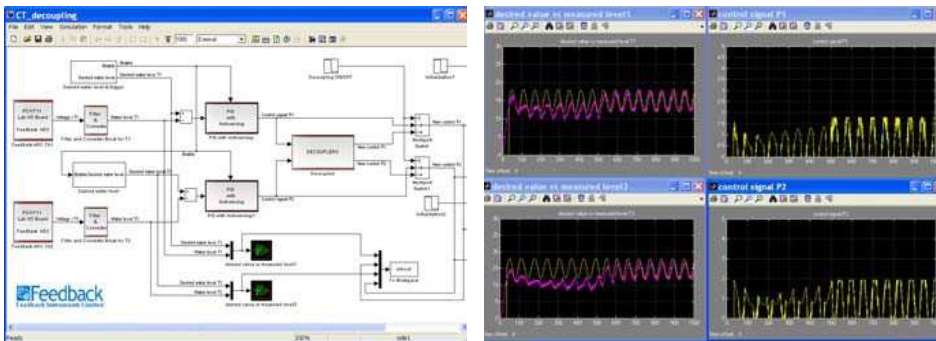
## Tender Specification

- [1] A self-contained Coupled Tanks System.
- [2] Four tanks with configurable coupling.
- [3] Tank capacity of 3.8 litres.
- [4] Two independently controlled pumps.
- [5] Flow rates greater than 10 litres/minute.
- [6] Curriculum to cover dynamics decoupling with cross-coupling identification.
- [7] Supplied with a manual with at least fourteen exercises.
- [8] Bench mounted dimensions: 1360 mm x 680 mm x 450 mm, with a dry weight of 36 kg.
- [9] To be supplied by a company offering a 1 year parts and labour warranty.

## Ordering Information

Coupled Tanks System

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*MATLAB™ screens of model and control responses*

# Feedback

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