SOSGO
MECHATRONIC SOLUTIONS

VICL

A solution to e-lab.

Virtual Instrument based Control Laboratory Trainer

VICL: Analog & Digital Servo Control System

Analog & Digital Servo Control System presents a good educational laboratory environment for students to understand fundamentals of DC servomotor control while training basics and professional motor control experiments.

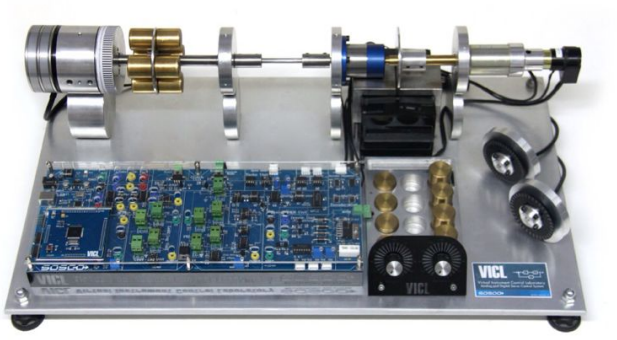
VICL is a portable standalone trainer which only needs a PC or a laptop to control onsite or online (remote) through the internet.

VICL system covers analog, digital and nonlinear control (using a flexible axis) experiments. The mechanical structure of the VICL is designed somehow to make it as small as possible. All parts are implemented in one line (axis) which simplifies its visualizing and manipulating. VICL set up includes;

- A DC servomotor with gearbox
- A 2-phase optical shaft encoder
- A tacho-genarator
- An industrial free running potentiometer
- An electrical clutch mechanism
- An eddy current brake (friction load) mechanism
- Three sets of inertial load
- A circuit board including all sensors and RS-232 interfaces, analog PID/Lead-Lag controller, pre-amplifier, zero-span circuit, PWM generator, H-bridge motor driver and embedded AT-Mega microcontroller.

MATLABTM is also embedded in the VICL software to make a more powerful environment for control laboratory subjects.

VICL as an e-Laboratory



A remote laboratory is an experiment, demonstration, or process running locally but with the ability to be monitored and controlled over the Internet from within a Web browser [NI]. VICL is interfaced to a PC via RS232. This PC is configured as a LabVIEW 7 Web server which might be accessed through internet by students. The GUI program also conducts students to collect all the results including tables, graphs and individual numbers in a standard format to be used in an automatic report generation. All standard control experiments are designed to enable students interactively to follow the instructions, tune the input parameters, select the control mode and collect the output data in a table format.

As visual feedback is essential for students running a laboratory experiment, an IP-camera could be added optionally.

Topics covered in VICL:

- System Modelling & Simulation
- System Parameter Estimation
- Step Response
- Frequency Response
- Inertial Load Effects
- Frictional Load Effects
- Analog & Digital Control
- Speed Control
- Position Control
- Lead-Lag Control
- PID Control
- State Space Feedback
- Discrete Sampling
- Non-Linear Control
- Real-Time Control
- HIL
- Teleoperation
- Microcontroller Embedded Control
- System Identification
- Virtual Instrument
- Labview HMI
- Eddy Current Brake

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VICL package includes complete online course/handout materials making lab. experiments straightforward.

- The plug-and-play feature makes VICL easy to setup and perform experiments quickly.
- VICL Trainers are suitable for a variety of Control Engineering, Mechatronics, Electrical Engineering, Physics, and Mechanical Engineering disciplines.
- VICL Trainers are suitable for Virtual Universities.
- VICL as a hardware-in-the-loop facility is a good setup to experience novel aspects of control theory.
- VICL could be with students in their homes at nights and holidays.

KEY FEATURES:

- HMI based on NI LabVIEW
- Analog Position & speed sensors
- Analog / Digital Control Methods
- Digital Position & speed sensors
- Modeling
- Built in A/D, D/A(PWM), Power Amp.
- Speed Control
- Embedded (AVR microcontroller)
- Postion Control
- Inertial & Friction Load
- PID, Lead-Lag Controller Design
- Plugs directly into AC outlet
- Real-time Embedded Control
- Portable, Compact, Standalone

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SYSTEM PARAMETERS

Motor			
Nominal voltage	U_N	24	Volt
Terminal resistance	R	2.0	Ω
Output power	$P_{2max.}$	70.8	W
Effi ciency	$\eta_{max.}$	83	%
No-load speed	n_o	5300	rpm
No-load current (with shaft ø 0.16 in)	I_o	0.100	A
Stall torque	M_H	72.22	oz-in
Friction torque	M_R	0.609	oz-in
Speed constant	K_N	223	rpm/V
Back-EMF constant	K_E	4.490	mV/rpm
Torque constant	K_M	6.075	oz-in/A
Current constant	K_L	0.165	A/oz-in
Planetary Gearheads			
reduction ratio		43 : 1	
output torque (continious)		1.416	oz-in
Encoder			
Lines per revolution	N	500	
Signal output, square wave channels		2+1	channels
Supply voltage	V_{CC}	4.5 ... 5.5	V DC
Current consumption, typical (VCC = 5 V DC)	I_{CC}	57	mA
Tacho-generator			
EMF constant	K_E	4.3	mV/RPM
Tolerance of EMF constant		± 1	%
Load resistance	R_L		
Operating speed, max. continuous	$n_{emax.}$	≤ 5000	rpm
Terminal resistance	R	260	Ω
Potentiometer			
Effective Electrical Angle		350 ° ±2 °	Deg.
Independent Linearity		±0.25	%
Life - Rotational (No Load)		25,000,000	Cycle