SISO Vs MIMO

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MIMO Control System:

MIMO control system is multiple input multiple output control system it has multiple variables some are manipulated variables input from FB (closed loop) or independent (open loop) and some are controlled variables to be output from the system, which require multiple control loops. MIMO systems can be complicated through loop interactions that result in variables with unexpected effects. MIMO control systems have multiloop control that means each manipulated variable depends on only a single controlled variable, and multivariable control than means each manipulated variable can depend on two or more of the controlled variables.

Difference between MIMO and SISO:

COMP	MIMO	SISO
Complexity	More Complex	Less Complex
NO. Inputs	More Than one	One
NO. Outputs	More Than one	One
Types	Closed Loop (FB) Open Loop	Closed Loop (FB) Open Loop
Output Dependence	Manipulated variables may affect several controlled variables	Each controlled variable is only manipulated by one variable

We can convert MIMO into SISO for more simplicity by:

- Decentralized control: every input signal is determined only by feedback from one output.
- Pairing problem: choose use of input-output Paris for feedback.
- Decoupled control: change of variables to facilitate input-output pairing.

When to use MIMO?

When we have a control system with more than one output (controlled variables) depend on more than one input (manipulated variables) and we can't separate the outputs and inputs to make each output depends on only one input.

Examples of MIMO systems:

include heat exchangers, chemical reactors, and distillation columns. These systems can be complicated through loop interactions that result in variables with unexpected effects. Decoupling the variables of that system will improve the control of that process.

Heat exchanger:

Multiple sensor data is integrated to coordinate multiple actuators, flow rate (FC) and temperature (TC) are used to control multiple valves (v1, v2, and v3). Often, MIMO systems are not PID controllers but rather designed for a specific situation.