Control Systems

University Electrical Engineering · Vocabulary in context

Word	Example
control systems	**Control systems** keep a drone level when the wind pushes it.
feedback /'fi:dbæk/	**Feedback** lets the system check the result and adjust.
plant /plænt/	The **plant** is the motor being controlled; the controller is separate.
transfer function	With zero initial conditions, the **transfer function** is Y(s)/U(s). Y(s)/U(s)
state variable	Each **state variable** stores one piece of the system history.
time constant /taɪm 'kɒnstənt/	The **time constant** is RC. RC
back-EMF	The spinning motor generates a **back-EMF** that limits its speed.
linearization /ˌlɪnɪəraɪ'zeɪʃn/	**Linearization** uses a local linear approximation around an operating point.
operating point	Choose an **operating point** before forming a local linear model.
natural frequency /'nætʃərəl 'fri:kwənsi/	A swing has its own **natural frequency**.
block diagram	A **block diagram** shows signals flowing through blocks and summers.
characteristic equation /ˌkærɪktə'rɪstɪk ɪ'kweɪʒn/	The roots of the **characteristic equation** show how the system behaves.

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damping ratio	A **damping ratio** of 1 gives critical damping. 1
step response /step rɪ'spɒns/	The **step response** shows how the circuit reacts to a sudden switch-on.
overshoot /ˌəʊvə'ʃu:t/	With final value 10, 20% **overshoot** gives peak 12. 10、 20% 12
peak time	**Peak time** marks the first peak of an underdamped step response.
settling time	The **settling time** is when the response stays inside the 2 percent band. 2 percent
rise time	A 10–90% **rise time** measures travel between two specified response levels. 10–90%
steady-state error	The **steady-state error** is the error left after the response settles.
system type	**System type** counts uncancelled integrators in the loop transfer function.
velocity error constant	The **velocity error constant** sets the error when the input is a ramp.
Routh array	Build the **Routh array** and count the sign changes in the first column.
auxiliary equation /ɔ:k'sɪlɪəri ɪ'kweɪʒn/	The zero row means symmetric roots; solve the **auxiliary equation**.
marginal stability	An undamped oscillator shows **marginal stability**: it keeps oscillating for ever.

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root locus	**Root locus** traces closed-loop poles as a chosen loop gain varies.
asymptote /'æsɪmptəʊt/	The graph of $y = e^{x}$ has a horizontal **asymptote** at $y = 0$. $y = e^{x}$ $y = 0$
breakaway point	The branches leave the real axis at the **breakaway point**.
phase margin	At gain crossover, **phase margin** measures separation from $-180°$. $-180°$
gain crossover	At the **gain crossover** the loop magnitude equals one.
gain margin	At phase crossover, **gain margin** compares loop magnitude with unity.
phase crossover	The gain margin is read at the **phase crossover** frequency.
Nyquist criterion	The **Nyquist criterion** says sample at more than twice the highest frequency.
encirclement	Count net **encirclement**s of -1, keeping the traversal direction explicit. -1
PID controller	A **PID controller** combines proportional, integral and derivative actions. `
proportional /prə'pɔːʃənl/	The **proportional** term reacts to the error now.
integral /'ɪntɪgrəl/	Use an **integral** to find the charge in a pulse.
derivative /dɪ'rɪvətɪv/	**Derivative** action responds to changes in error and can add damping.

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Word	Example
lead compensator	A **lead compensator** adds positive phase over a frequency band.
anti-windup	**Anti-windup** limits unwanted integral accumulation when the actuator saturates.
state space	**State space** models several internal variables together.
eigenvalue /'aɪgənvæljuː/	**Eigenvalue**s of A determine the modes of a linear state model. A
transition matrix /træn'sɪʃn 'meɪtrɪks/	With zero input, x(t)=e^(At)x(0) uses the **transition matrix**. x(t)=e^(At)x(0)
controllability	**Controllability** means the input can drive the state in every direction.