Definition of Stability

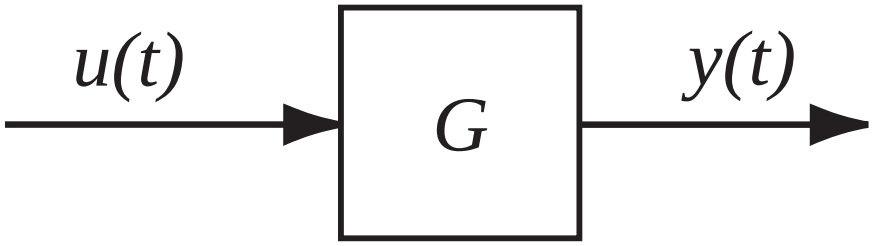
Stability is an important concept in linear systems — we all want to fly in airplanes with stable control systems! Although many of us have an intuitive feel for the idea of "stability," we need a working definition that will allow us to classify systems as either stable or unstable.

Working with a partner, draft a definition of stability. The definition should be specific enough that you can test whether a system with impulse response $g(t)$ (or equivalently, transfer function $G(s)$) is stable or not.

Note: There are dozens, and maybe hundreds, of definitions of stability. There is no "wrong" answer!

When you are finished, press "1" on your PRS remote.

Definition of Stability
Solution



The LTI system G is Bounded Input / Bounded Output (BIBO) stable if every bounded input $u(t)$ produces a bounded output $y(t)$.

Basically, this definition says that every “nice” input produces a “nice” output.

BIBO Stability I

Consider the systems F, G, and H, with impulse responses given by

$$\begin{aligned} f(t) &= \sigma(t)e^{-2t} \\ g(t) &= \sigma(t) \\ h(t) &= \sigma(t)e^{t} \end{aligned}$$

Which of the systems are BIBO stable?

1. F, G, and H
2. F and G
3. F only
4. G and H
5. H only
6. none of the above

BIBO Stability I

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Which of the systems are BIBO stable?

The correct answer is:

1. F, G, and H
2. F and G
3. ♡ F only
4. G and H
5. H only
6. none of the above

BIBO Stability II

Consider the system G with impulse response given by

$$g(t) = \frac{1}{1+t}\sigma(t)$$

Is the system G BIBO stable?

1. Yes
2. No
3. Don’t know

BIBO Stability II

Consider the system G with impulse response given by

$$g(t) = \frac{1}{1+t}\sigma(t)$$

Is the system G BIBO stable?

The correct answer is:

1. Yes
2. ♡ No
3. Don't know

BIBO Stability III

Consider the system G with impulse response given by

$$g(t) = \frac{1}{\sqrt{t}}\sigma(t)$$

Is the system G BIBO stable?

1. Yes
2. No
3. Don’t know

BIBO Stability III

Consider the system G with impulse response given by

$$g(t) = \frac{1}{\sqrt{t}}\sigma(t)$$

Is the system G BIBO stable?

The correct answer is:

1. Yes
2. ♡ No
3. Don't know