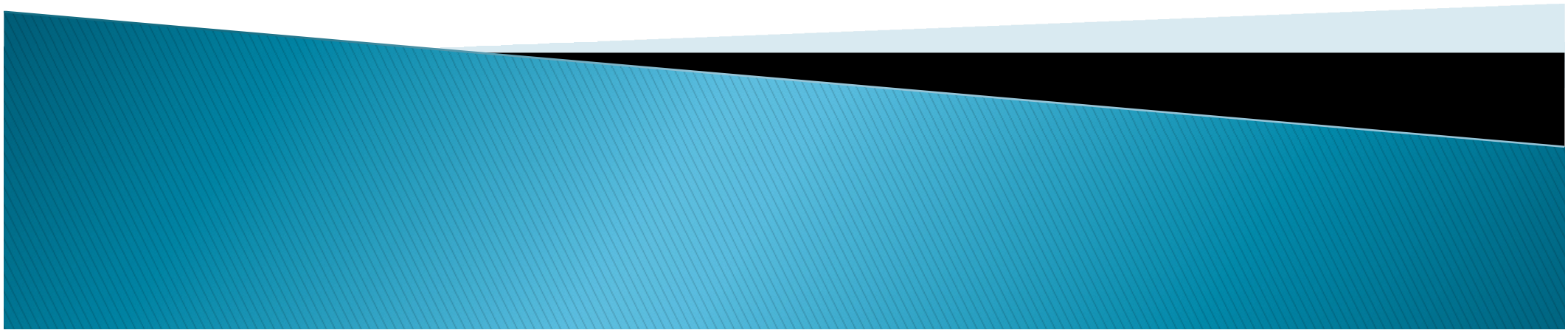
Universidad de Oviedo

ingeniería de sistemas y automática

Sensores

Sistemas Automáticos- Tema 14



Contenidos

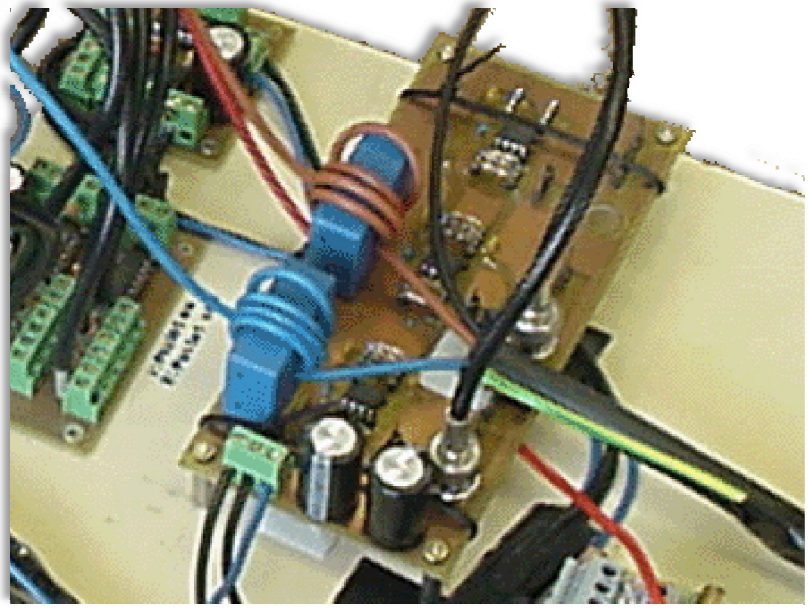
- Características de los sensores
- Límites de la medida
- Acondicionamiento de la señal
- Errores de la medida
- Derivas
- Respuesta dinámica

Características de los sensores

- Dinámicas

  Respuesta dinámica

  Derivas (drift)



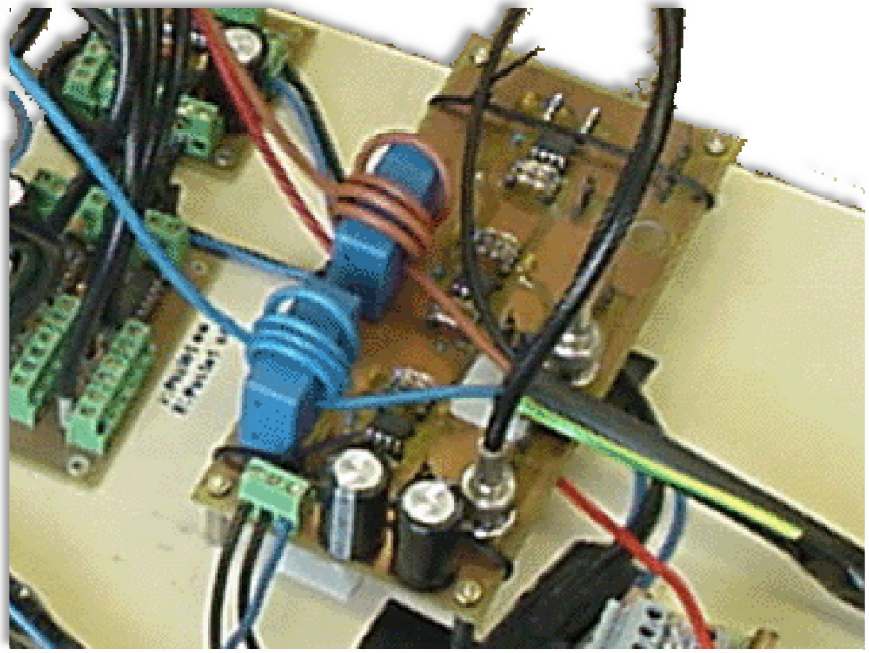
- Estáticas

  Límites de la medida
  - Rango de medida (input span)
  - Resolución (discrimination)

  Acondicionamiento de la señal
  - Rango de salida (output span)
  - Sensibilidad (sensitivity)

  Errores de la medida
  - Exactitud (accuracy)
  - Precisión, repetitividad (precision)
  - Linealidad (linearity)
  - Histéresis (hysteresis)
  - Offset

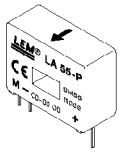
Características de los sensores



Current Transducer LA 55-P

I_{PN} = 50 A

For the electronic measurement of currents : DC, AC, pulsed..., with a galvanic isolation between the primary circuit (high power) and the secondary circuit (electronic circuit).



Electrical data

I_{PN}	Primary nominal r.m.s. current				50		A
I_P	Primary current, measuring range				0 .. ± 70		A
R_M	Measuring resistance @		T_A = 70°C		T_A = 85°C		
			$R_{M\,min}$	$R_{M\,max}$	$R_{M\,min}$	$R_{M\,max}$	
	with ± 12 V	@ ± 50 A_{max}	10	100	60	95	Ω
		@ ± 70 A_{max}	10	50	60 [1]	60 [1]	Ω
	with ± 15 V	@ ± 50 A_{max}	50	160	135	155	Ω
		@ ± 70 A_{max}	50	90	135 [2]	135 [2]	Ω
I_{SN}	Secondary nominal r.m.s. current				50		mA
K_N	Conversion ratio				1 : 1000		
V_C	Supply voltage (± 5 %)				± 12 .. 15		V
I_C	Current consumption				10 (@ ± 15 V) + I_S		mA
V_d	R.m.s. voltage for AC isolation test, 50 Hz, 1 mn				2.5		kV

Accuracy - Dynamic performance data

X	Accuracy @ I_{PN}, T_A = 25°C	@ ± 15 V (± 5 %)		± 0.65	%
		@ ± 12 .. 15 V (± 5 %)		± 0.90	%
ε_L	Linearity			< 0.15	%
			Typ	Max	
I_O	Offset current @ I_P = 0, T_A = 25°C			± 0.2	mA
I_{OM}	Residual current [3] @ I_P = 0, after an overload of 3 x I_{PN}			± 0.3	mA
I_{OT}	Thermal drift of I_O	0°C .. + 70°C	± 0.1	± 0.5	mA
		- 25°C .. + 85°C	± 0.1	± 0.6	mA
t_{ra}	Reaction time @ 10 % of $I_{P\,max}$			< 500	ns
t_r	Response time @ 90 % of $I_{P\,max}$			< 1	µs
di/dt	di/dt accurately followed			> 200	A/µs
f	Frequency bandwidth (- 1 dB)			DC .. 200	kHz

General data

T_A	Ambient operating temperature		- 25 .. + 85	°C
T_S	Ambient storage temperature		- 40 .. + 90	°C
R_S	Secondary coil resistance @	T_A = 70°C	80	Ω
		T_A = 85°C	85	Ω
m	Mass		18	g
	Standards [4]		EN 50178	

Notes : [1] Measuring range limited to ± 60 A_{max}
[2] Measuring range limited to ± 55 A_{max}
[3] Result of the coercive field of the magnetic circuit
[4] A list of corresponding tests is available

980706/8

Features

- Closed loop (compensated) current transducer using the Hall effect
- Printed circuit board mounting
- Insulated plastic case recognized according to UL 94-V0.

Advantages

- Excellent accuracy
- Very good linearity
- Low temperature drift
- Optimized response time
- Wide frequency bandwidth
- No insertion losses
- High immunity to external interference
- Current overload capability.

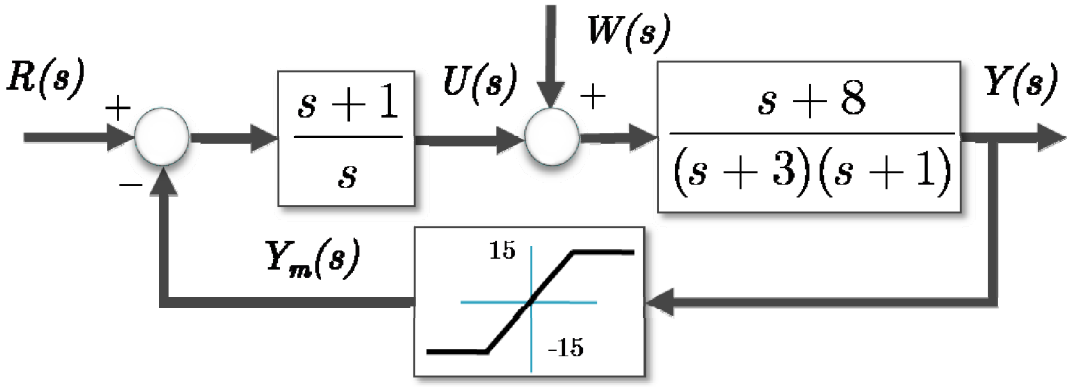
Applications

- AC variable speed drives and servo motor drives
- Static converters for DC motor drives
- Battery supplied applications
- Uninterruptible Power Supplies (UPS)
- Switched Mode Power Supplies (SMPS)
- Power supplies for welding applications.

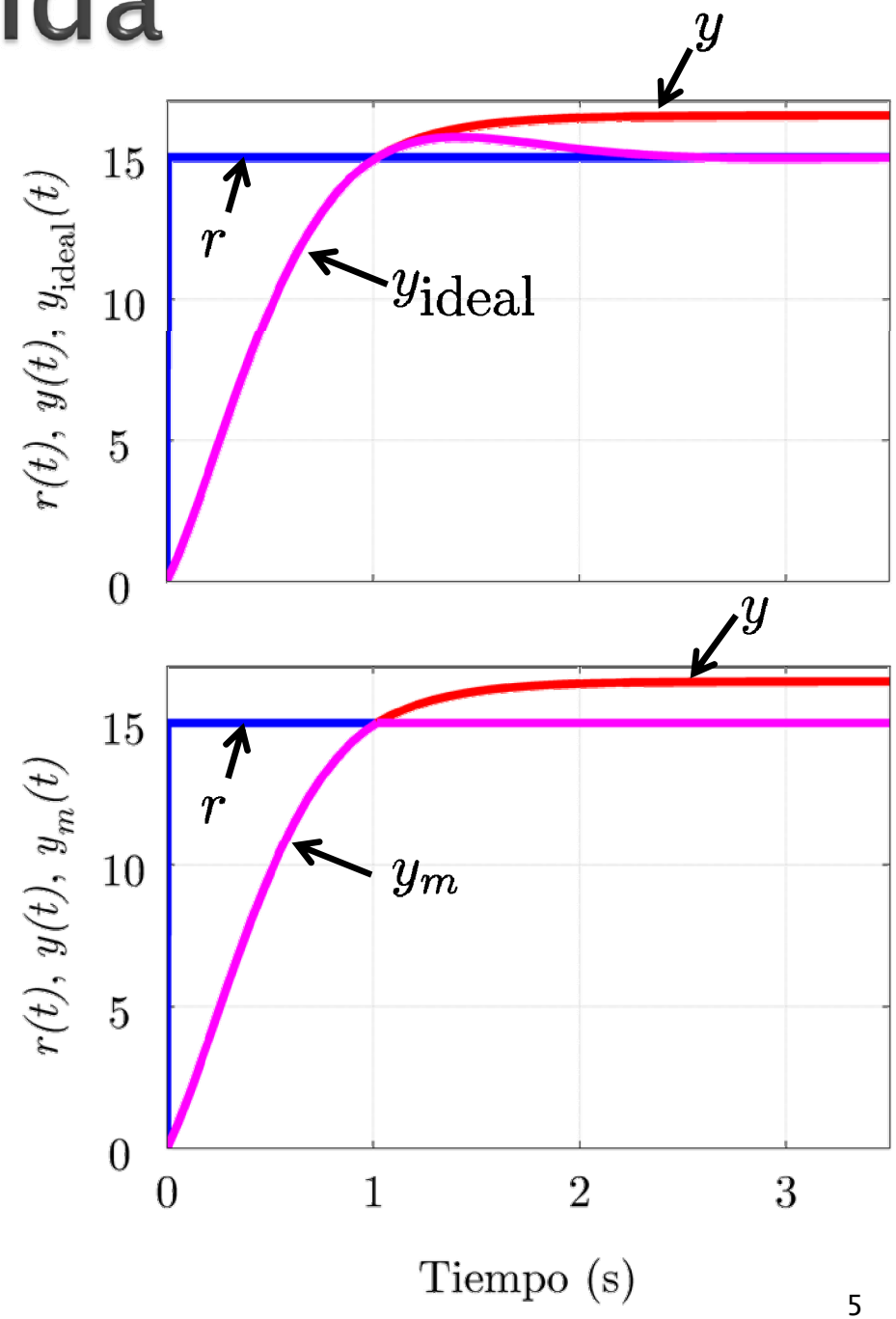
LEM Components www.lem.com

Límites de la medida

- Rango de medida

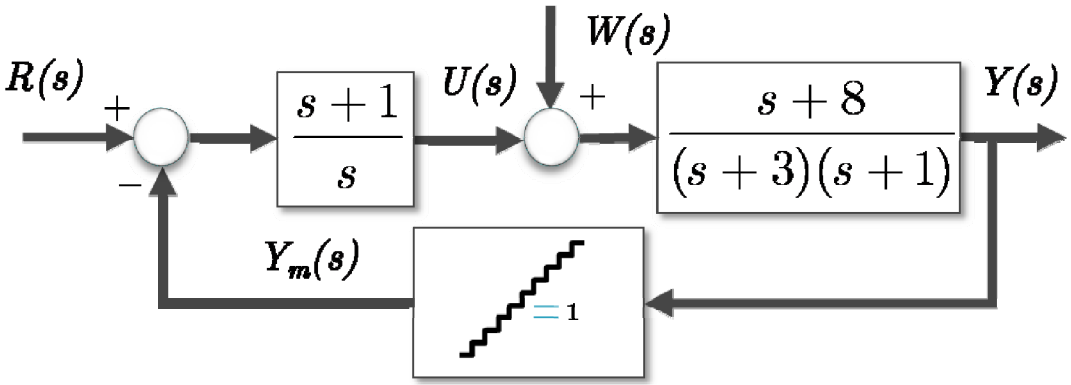


Electrical data							
I_{PN}	Primary nominal r.m.s. current			50			A
I_P	Primary current, measuring range			0 .. ± 70			A
R_M	Measuring resistance @		T_A = 70°C		T_A = 85°C		
			$R_{M\,min}$	$R_{M\,max}$	$R_{M\,min}$	$R_{M\,max}$	
	with ± 12 V	@ ± 50 A_{max}	10	100	60	95	Ω
		@ ± 70 A_{max}	10	50	60 [1)]	60 [1)]	Ω
	with ± 15 V	@ ± 50 A_{max}	50	160	135	155	Ω
		@ ± 70 A_{max}	50	90	135 [2)]	135 [2)]	Ω

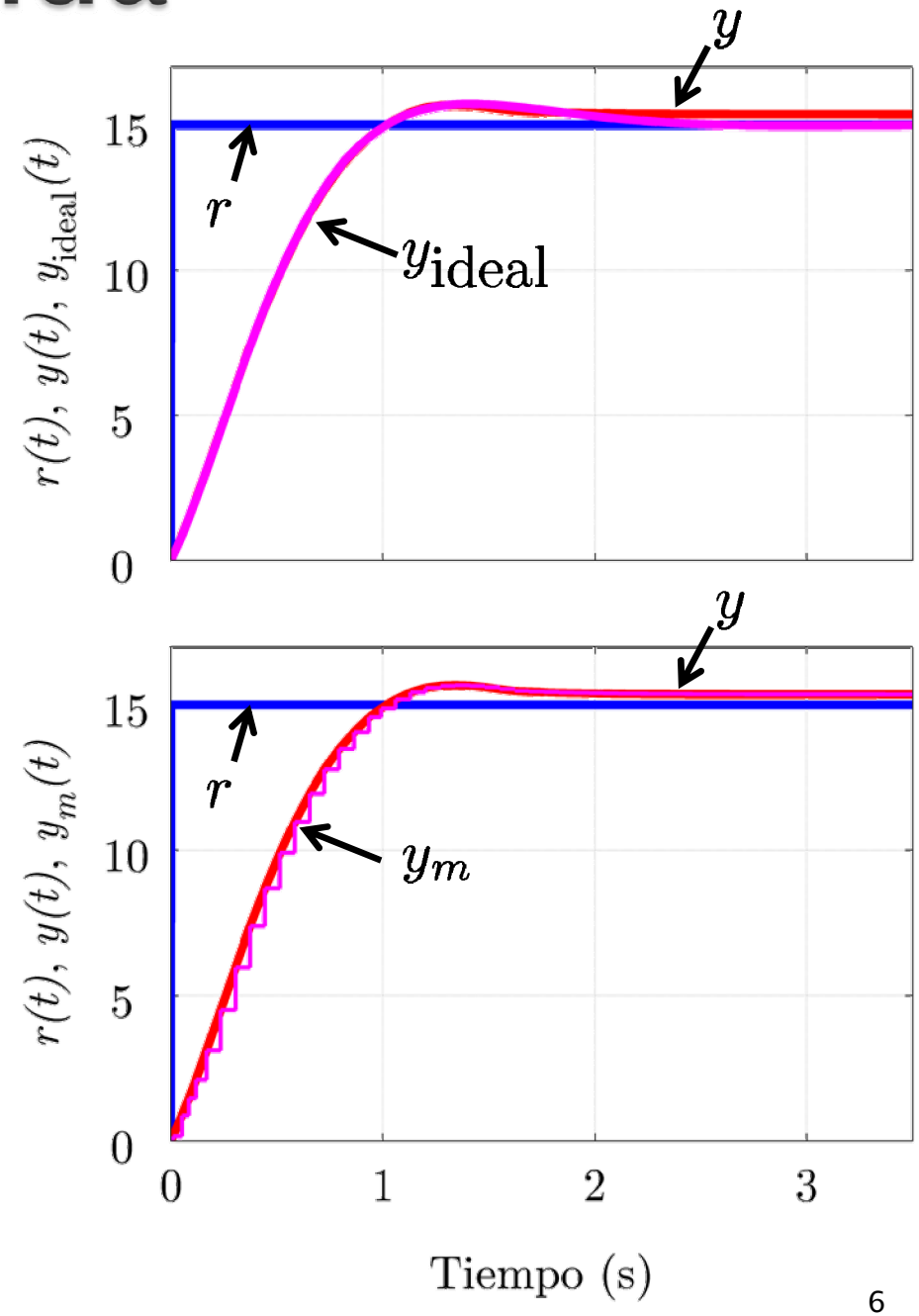


Límites de la medida

- Resolución

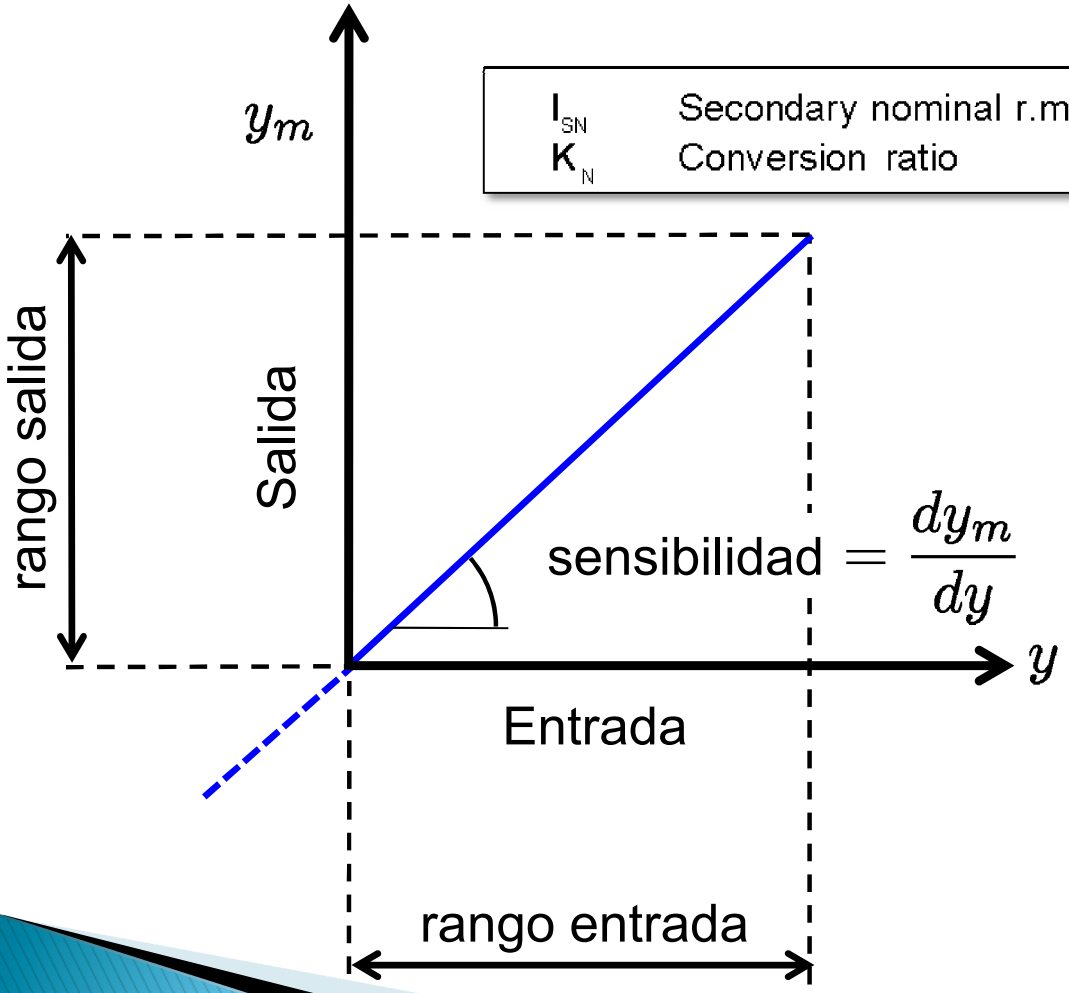


$$\text{error} \approx \frac{\text{resolución}}{2}$$

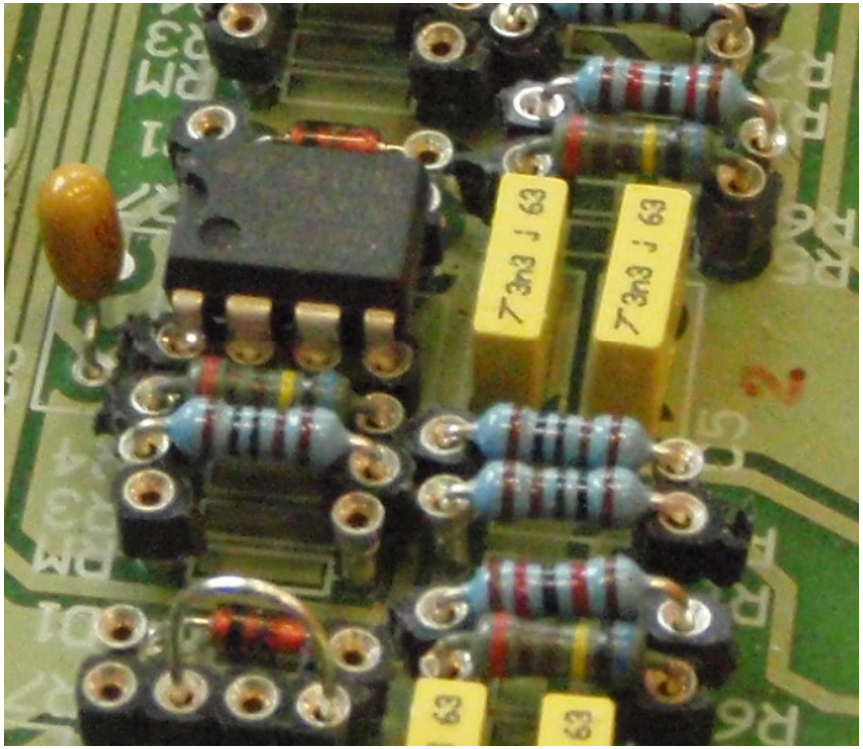


Acondicionamiento de la señal

- Rango de salida y sensibilidad



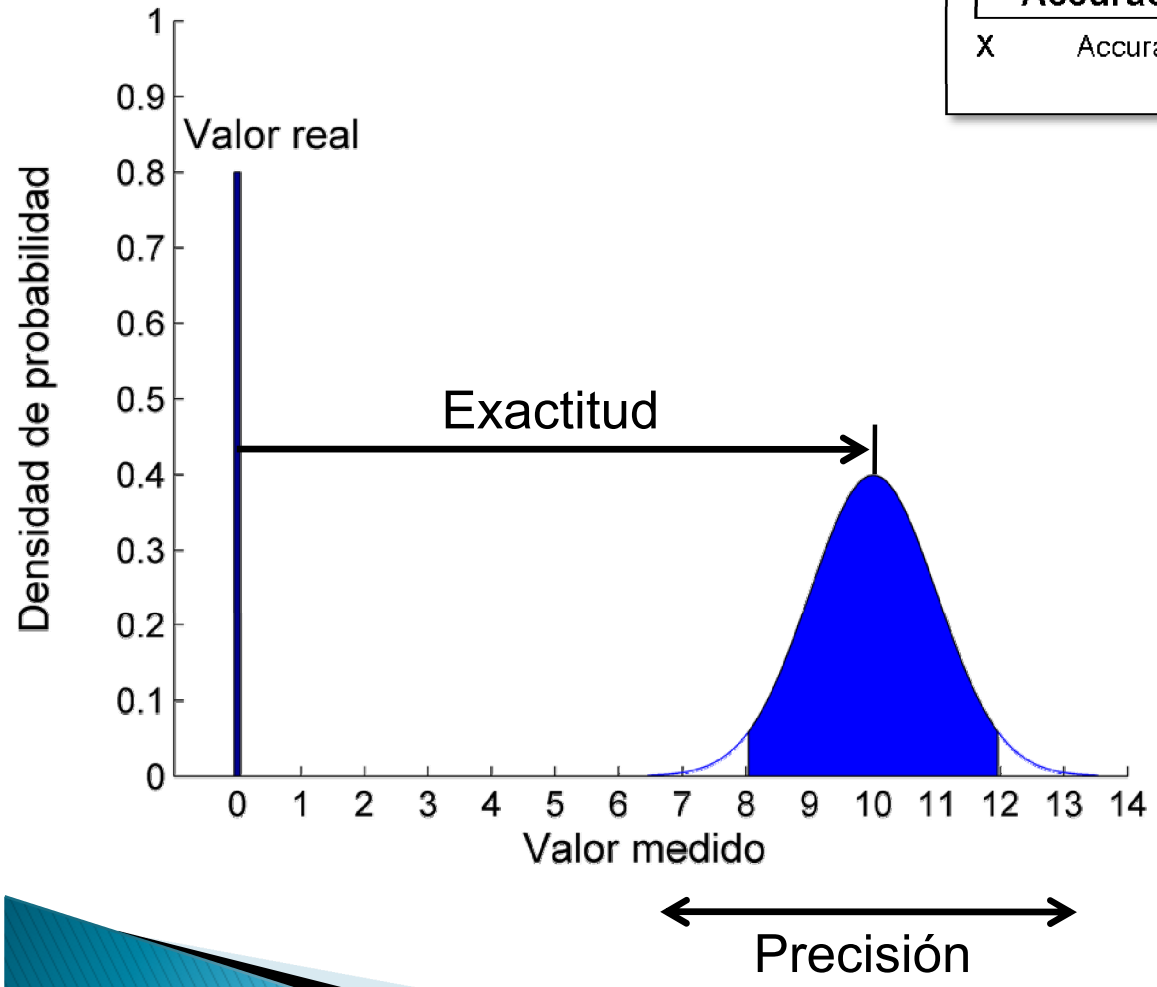
I_{SN}	Secondary nominal r.m.s. current	50	mA
K_N	Conversion ratio	1 : 1000	

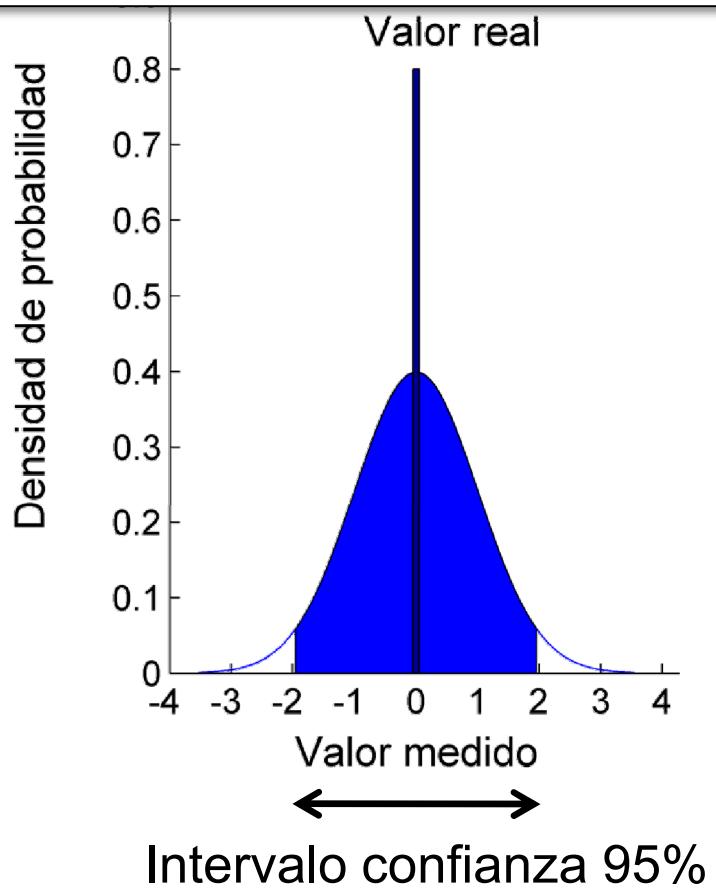


Errores de la medida

- Exactitud y precisión

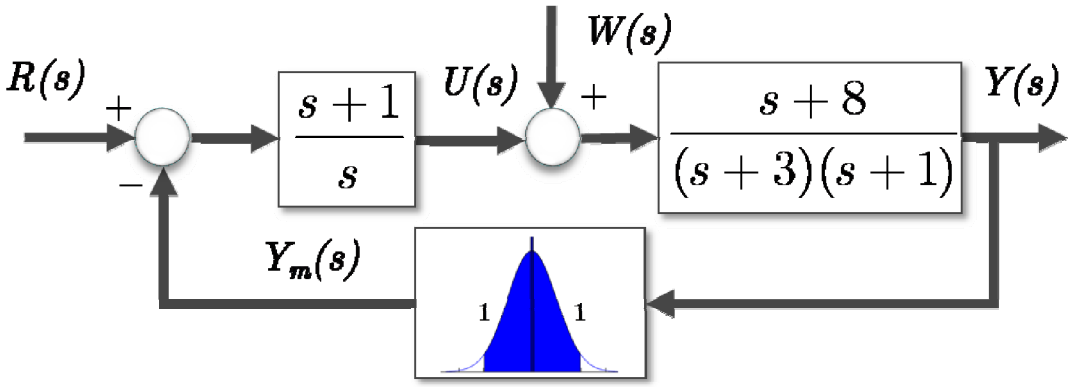
Accuracy - Dynamic performance data				
X	Accuracy @ I_{PN} , T_A = 25°C	@ ± 15 V (± 5 %)	± 0.65	%
		@ ± 12 .. 15 V (± 5 %)	± 0.90	%



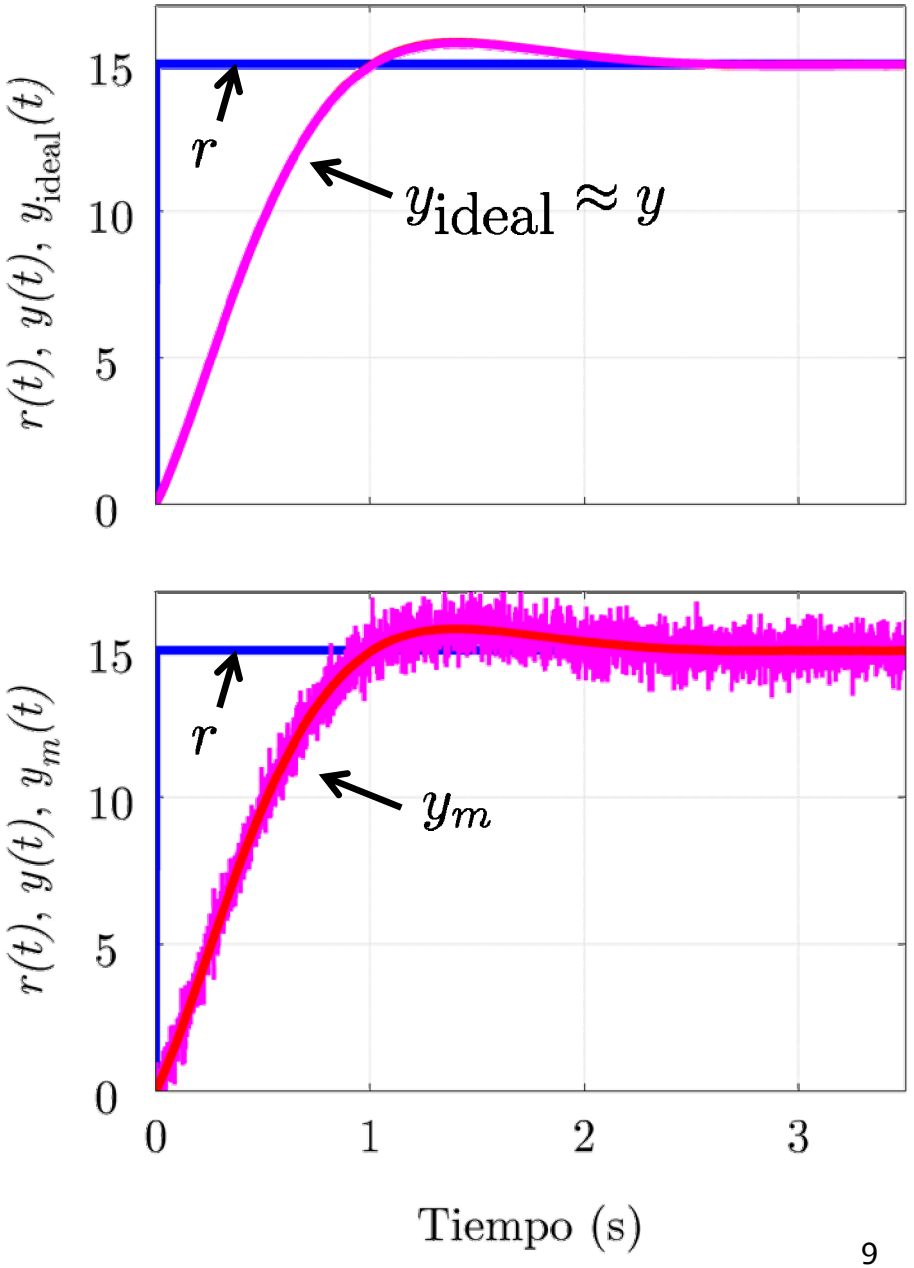


Errores de la medida

- Precisión

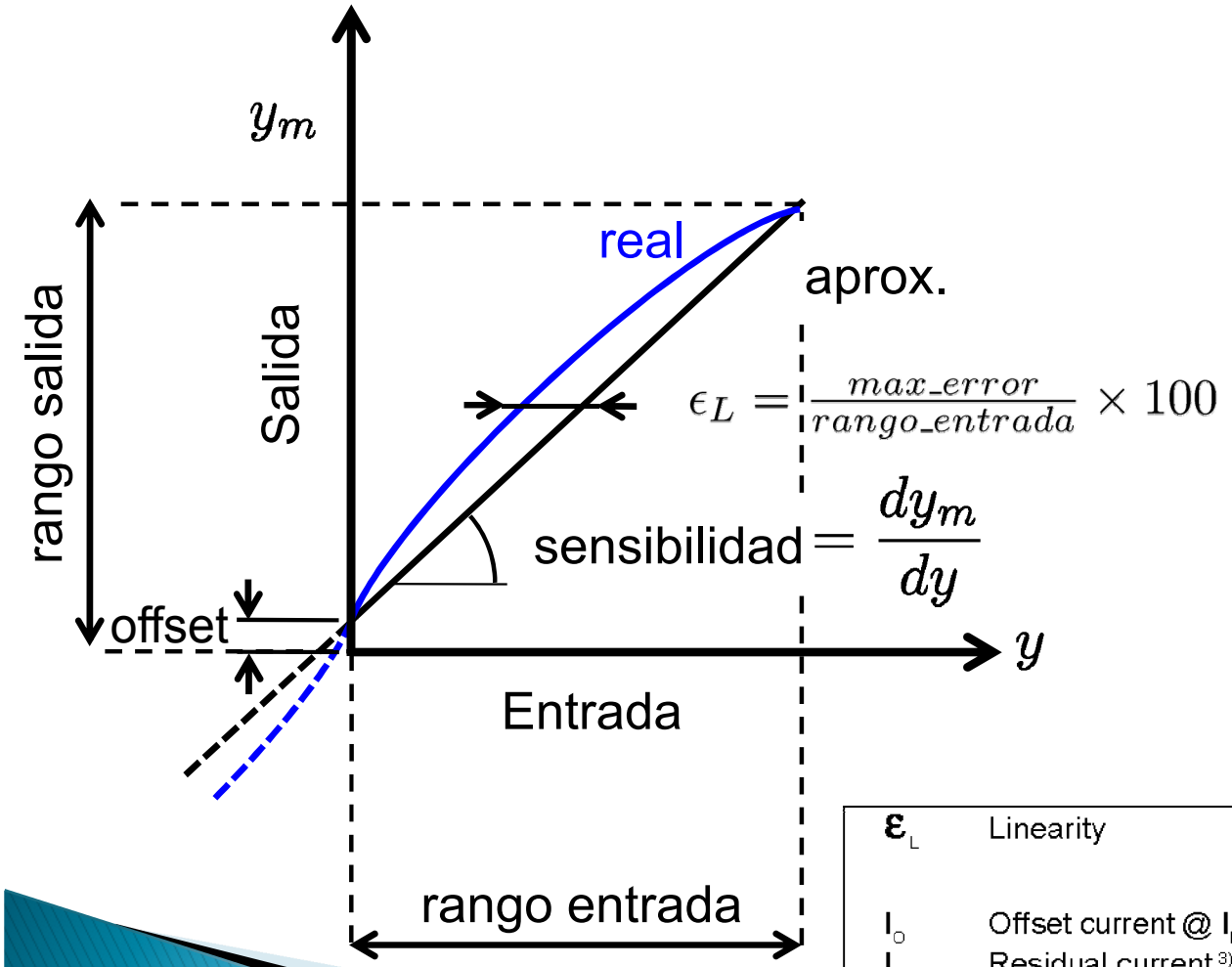


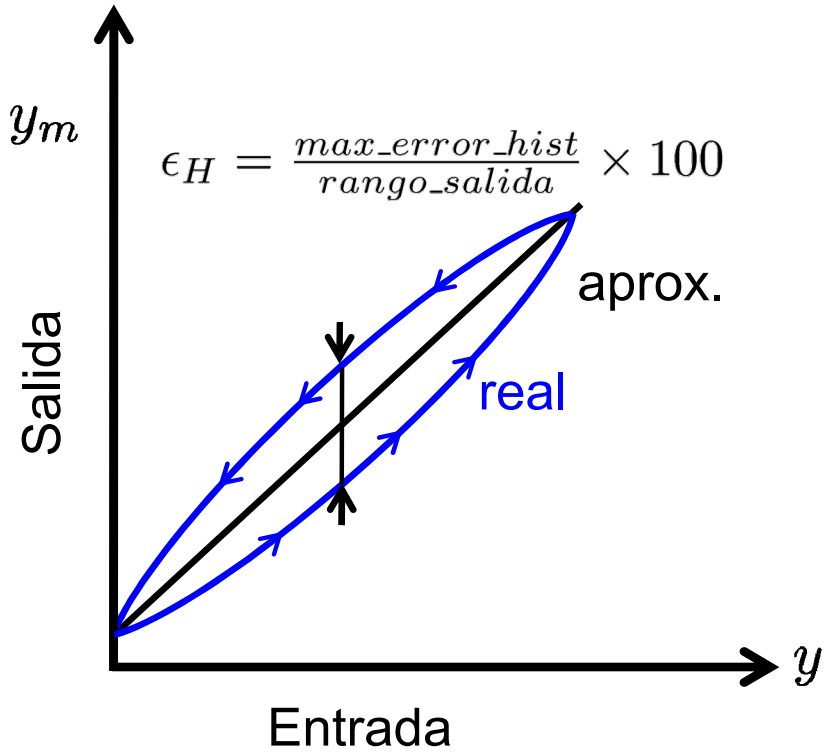
El efecto de la precisión se traduce en una fuente de ruido blanco gaussiano



Errores de la medida

- Linealidad, histéresis, offset

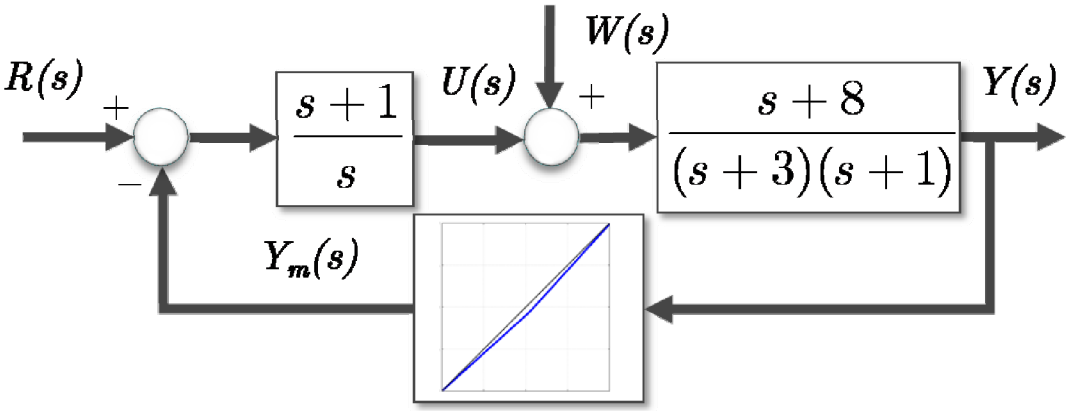


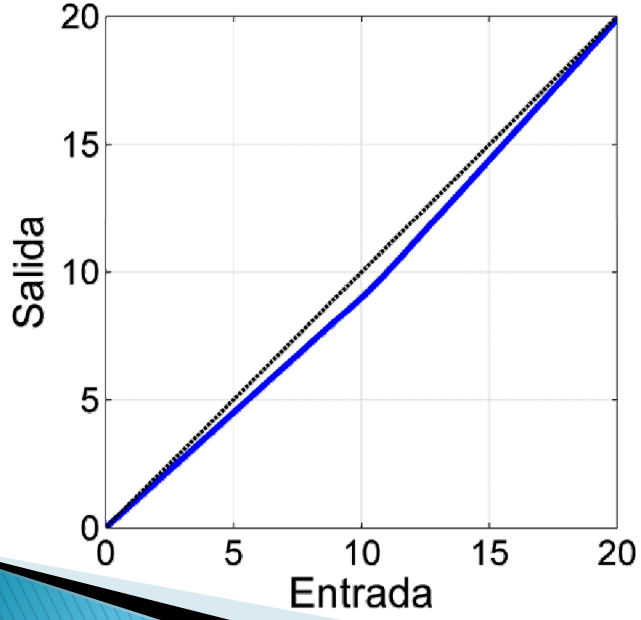


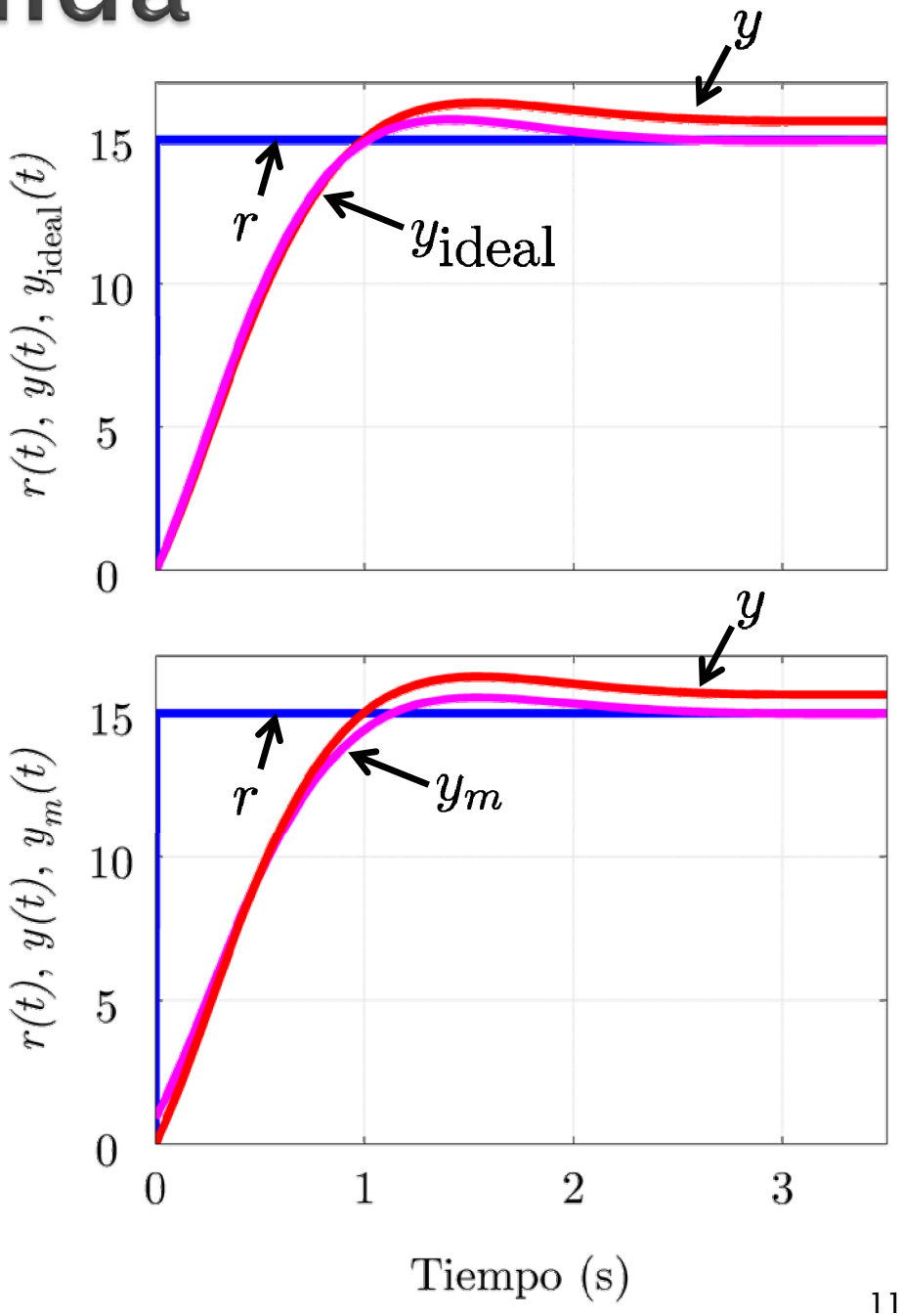
ε_L	Linearity		< 0.15	%
		Typ	Max	
I_O	Offset current @ I_P = 0, T_A = 25°C		± 0.2	mA
I_{OM}	Residual current [3] @ I_P = 0, after an overload of 3 x I_{PN}		± 0.3	mA

Errores de la medida

- Linealidad

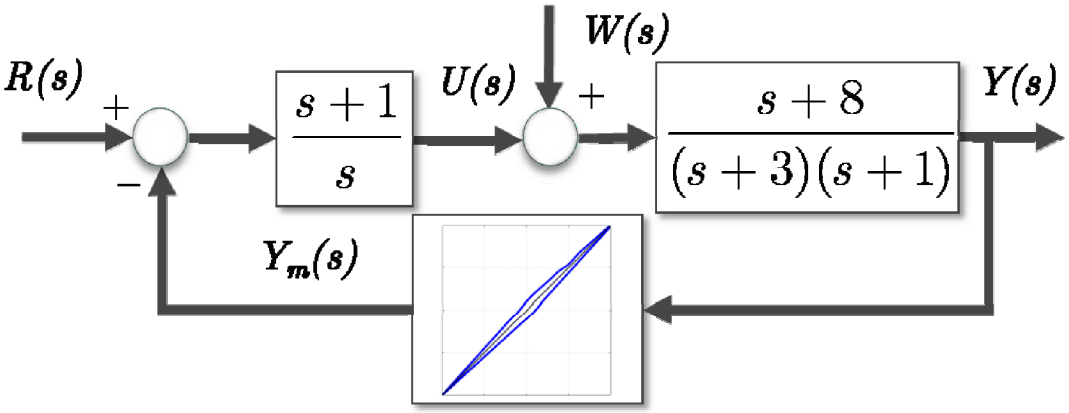


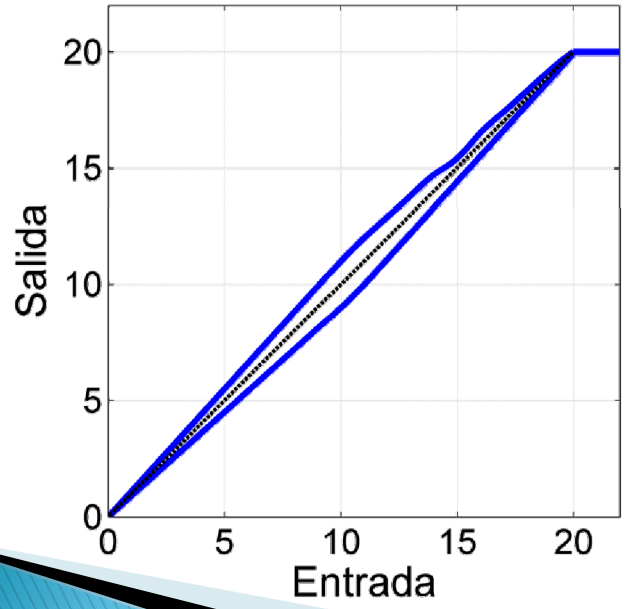


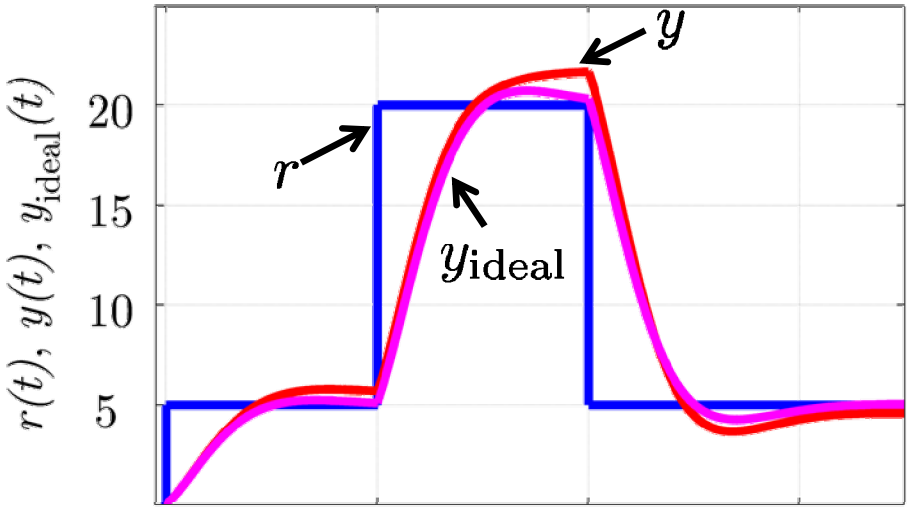


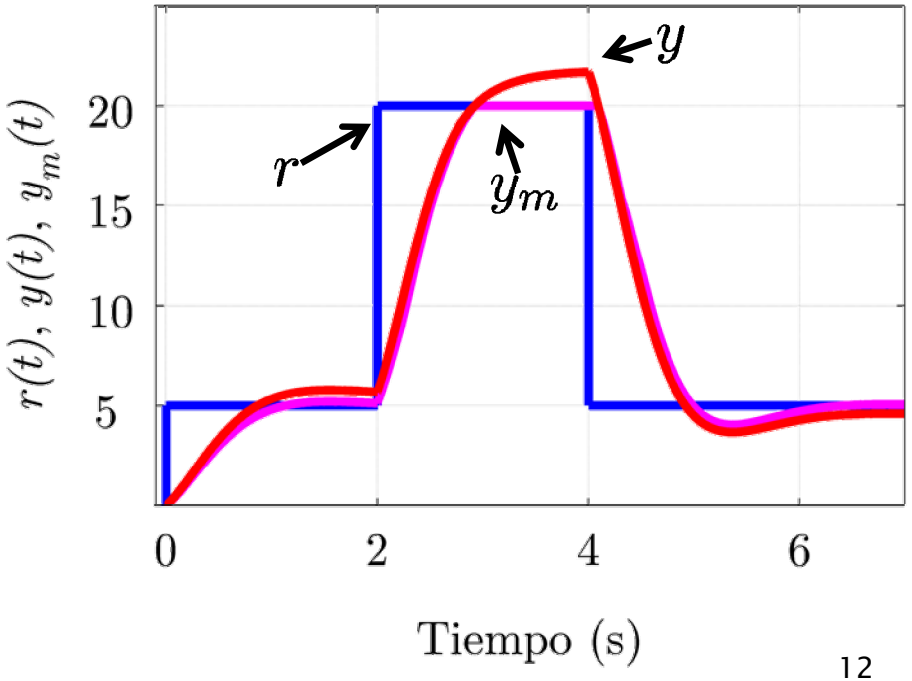
Errores de la medida

- Histéresis









Derivas

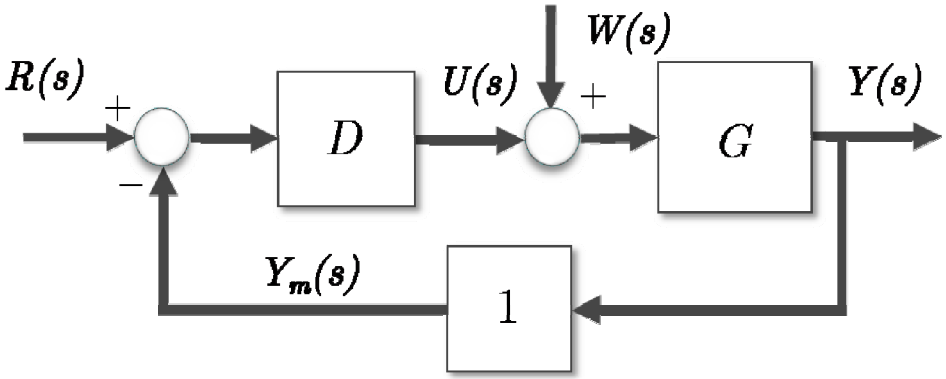
- Temperatura

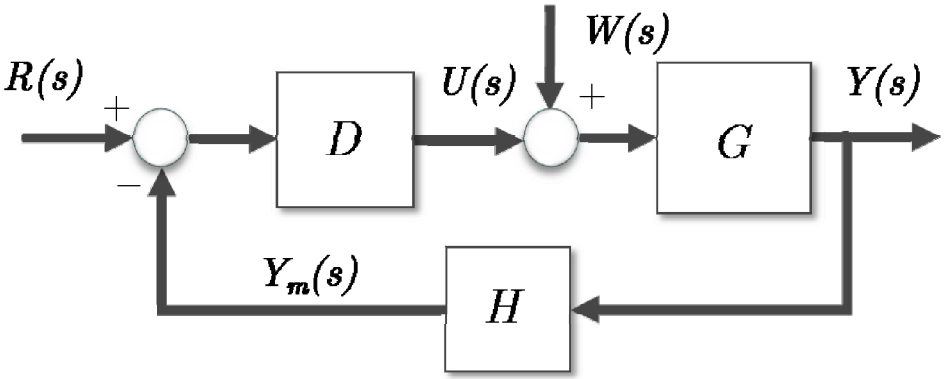
I_{OT}	Thermal drift of I_O	0°C .. + 70°C	± 0.1	± 0.5	mA
		- 25°C .. + 85°C	± 0.1	± 0.6	mA

- Envejecimiento (oxidación, desgaste)
- Humedad
- Suciedad

Respuesta dinámica

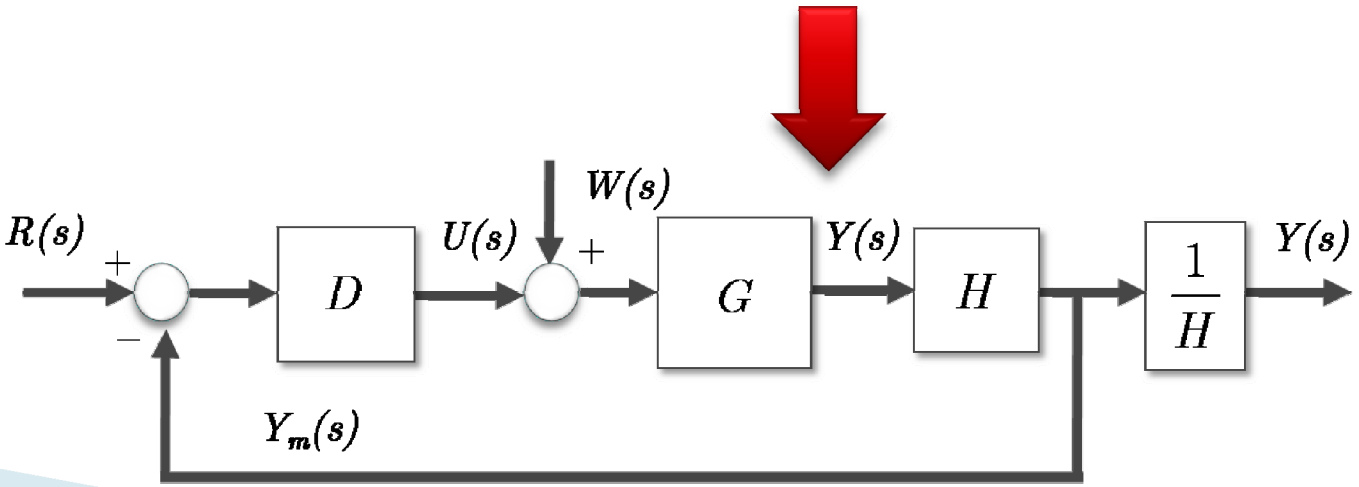
t_{ra}	Reaction time @ 10 % of $I_{P\,max}$	< 500	ns
t_r	Response time @ 90 % of $I_{P\,max}$	< 1	µs
di/dt	di/dt accurately followed	> 200	A/µs
f	Frequency bandwidth (- 1 dB)	DC .. 200	kHz





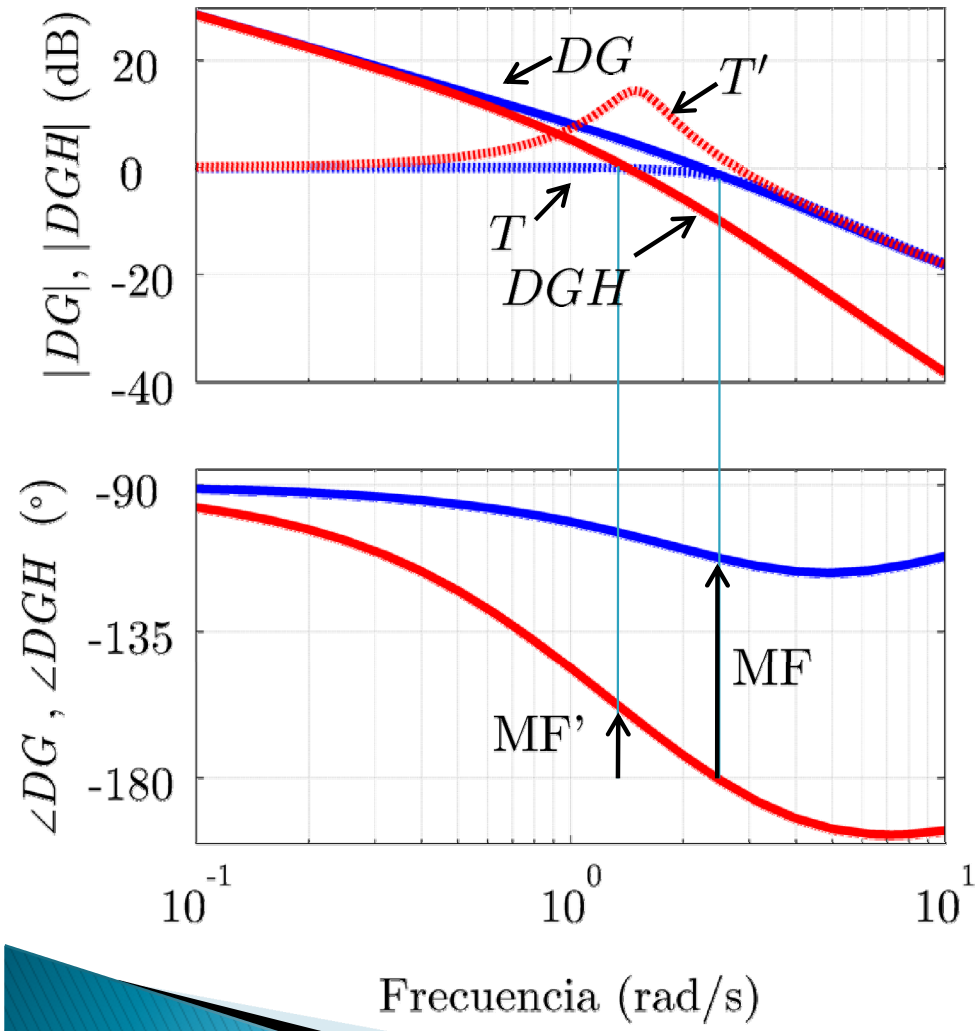
$$S = \frac{1}{1+DG} \quad T = \frac{DG}{1+DG} = S \cdot DG$$

$$S' = \frac{1}{1+DGH} \quad T' = \frac{DG}{1+DGH} = S' \cdot DG$$



Respuesta dinámica

Efecto de un sensor con dinámica lenta



Si el ancho de banda del sensor real no es mucho mayor que el ancho de banda del sistema realimentado con sensor ideal:

- El ancho de banda apenas se modifica
- Disminuye la estabilidad relativa
- Más sensibilidad
- Más oscilación
- Mayor tiempo de establecimiento