

# Delay-Induced Resonance

HOMENAJE AL PROF. MIGUEL ÁNGEL SANJUÁN

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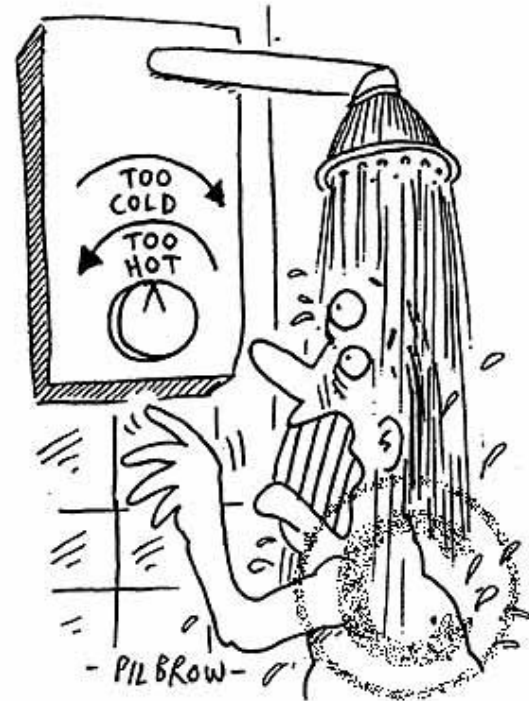


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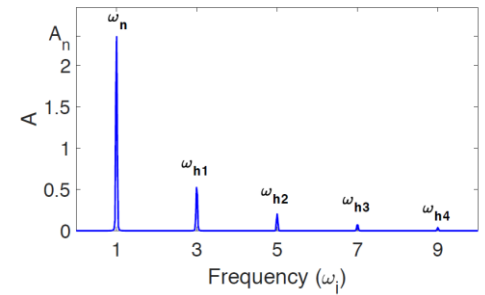
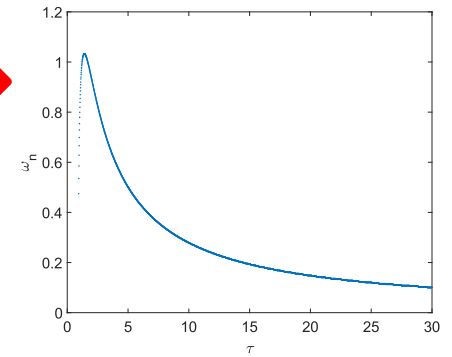
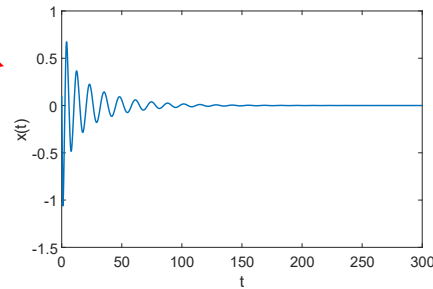
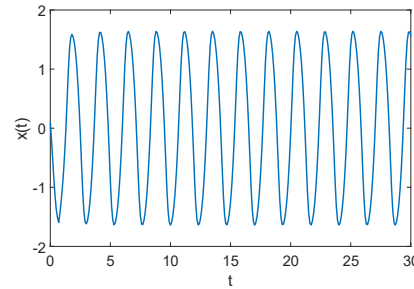
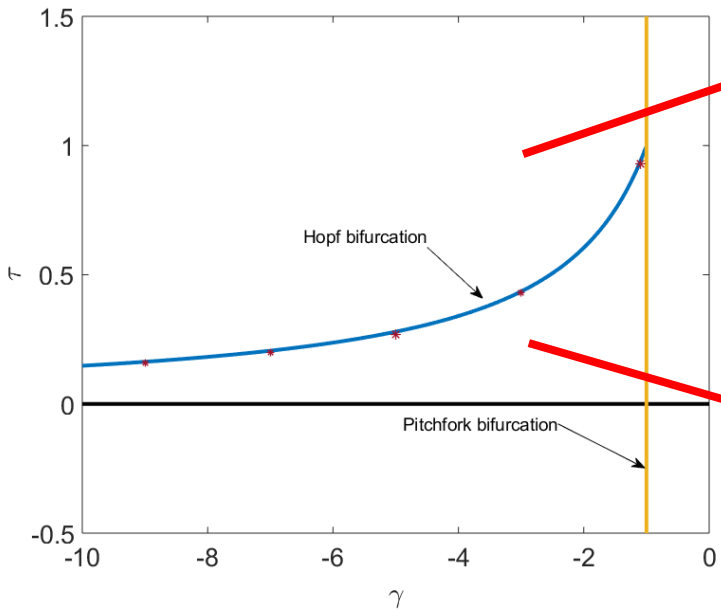
# Resonancia y Sistemas con Retardo

$$\dot{x} = f(t, x(t), x(t - \tau))$$



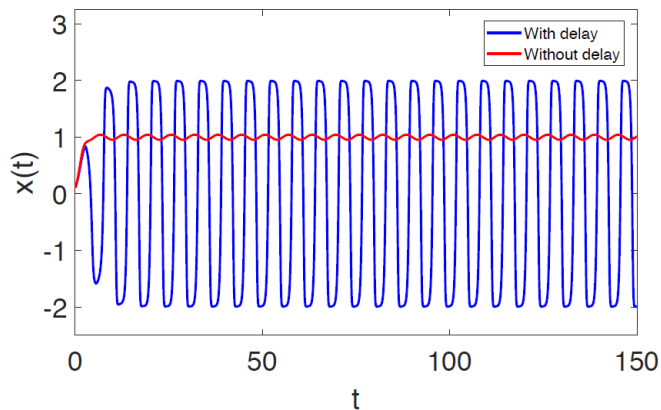
# Oscilador Duffing

$$\dot{x} - x + x^3 - \gamma x(t - \tau) = 0$$



# Oscilador Duffing

$$\dot{x} - x + x^3 - \gamma x(t - \tau) = g \cos \Omega t,$$

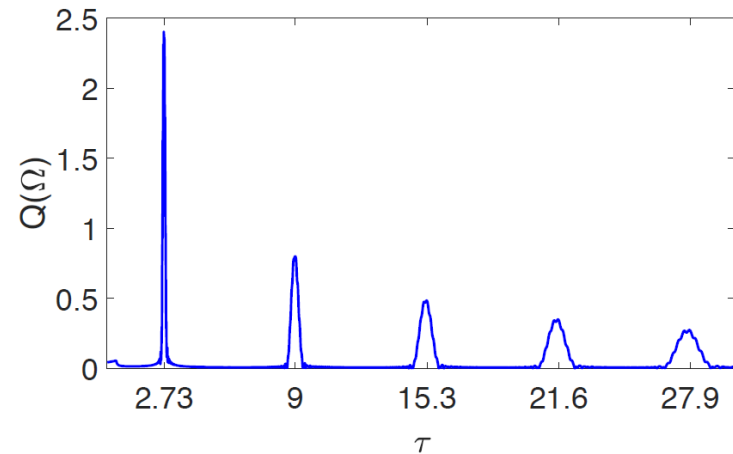


**“Un término de retraso puede ser usado como un potenciador eficiente de las oscilaciones causadas por un forzamiento manteniendo la misma frecuencia”**

# Delay-Induced Resonance

$$\dot{x} - x + x^3 - \gamma x(t - \tau) = g \cos \Omega t.$$

Value of $\tau$	Frequency Component
$\tau = 2.73$	$\omega_n = \Omega$
$\tau = 9$	$\omega_{h1} = \Omega$
$\tau = 15.3$	$\omega_{h2} = \Omega$
$\tau = 21.6$	$\omega_{h3} = \Omega$



Muchas gracias por su atención

Julia Cantisán, Mattia Coccolo, Jesús M. Seoane and, Miguel A.F. Sanjúan. International Journal of Bifurcation and Chaos (2019) **Delay-Induced Resonance in the Time-Delayed Duffing Oscillator.** [arXiv:1909.11357](https://arxiv.org/abs/1909.11357)