



# SNS COLLEGE OF TECHNOLOGY

Coimbatore-35  
An Autonomous Institution



Accredited by NBA – AICTE and Accredited by NAAC – UGC with 'A++' Grade  
Approved by AICTE, New Delhi & Affiliated to Anna University, Chennai

## DEPARTMENT OF AEROSPACE ENGINEERING

### 16AE315-THEORY OF VIBRATIONS

III YEAR VI SEM

UNIT II – SINGLE DEGREE OF FREEDOM SYSTEM

TOPIC – Free & Forced Damping Vibration

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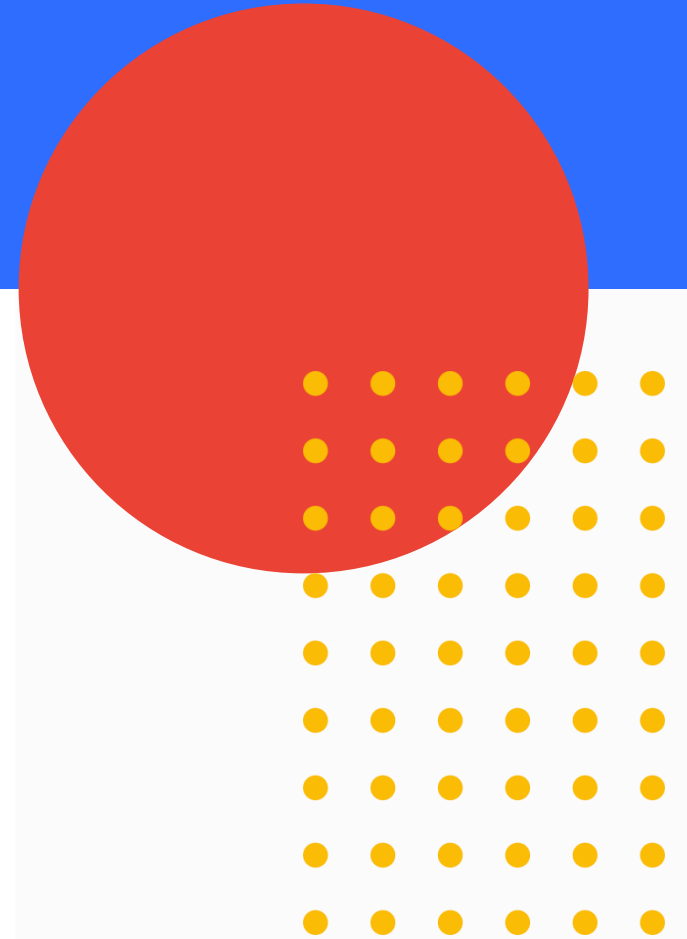




# Learning Objectives

## Free oscillators

- Undamped oscillator
- Natural frequency,  $f_0$
- No external forces
- e.g. swing





## Forced oscillators

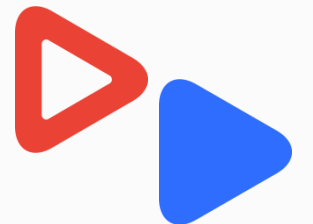
- External forces act on oscillator
- Forced/driven oscillator
- Resonance: driving  $f = f_0$
- e.g. loudspeaker  
vibrates in response to oscillating electric signal (driver)
- Barton's pendulums





# Problems

- Resonance driver applies forces that continually supply energy to oscillator → increasing amplitude
- $A$  increases indefinitely unless energy transferred away
- Severe case:  $A$  limit reached when oscillator destroys itself
- e.g. wine glass shatters when opera singer reaches particular note







# QUESTIONS RELATED TO ABOVE SLIDES





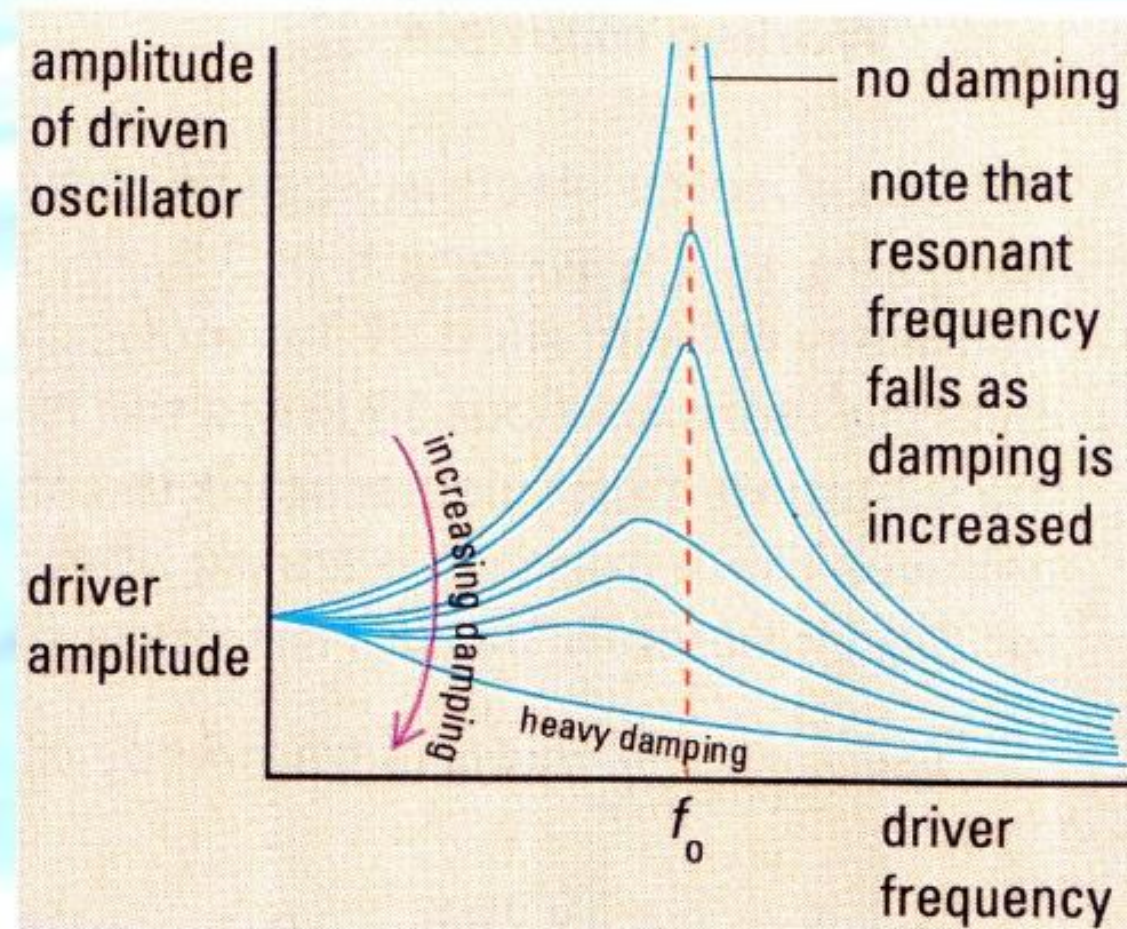
# Damping

- Resonant Amplitude limited by damping forces
- At resonance:  
rate of energy supply =  $WD$  against damping forces
- Increasing damping reduces sharpness + strength of resonance





# Resonance and damping

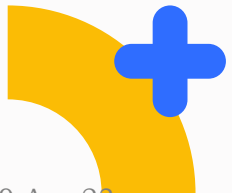






# Unwanted resonance

- Structures/machinery
- Results in destruction
- Damping
- Changing  $f_o$  of object by changing its mass
- Change stiffness of supports ( $\therefore$  moving resonant  $f$  away from driving  $f$ )







Model aircraft being tested for resonance in a wind tunnel





## REFERENCE LINKS

<http://160592857366.free.fr/joe/ebooks/Mechanical%20Engineering%20Books%20Collection/VIBRATIONS/mechVib%20theory%20and%20applications.pdf>

[https://books.google.co.in/books?id=0fl1pKtaghAC&printsec=frontcover&source=gbs\\_ge\\_summary\\_r&cad=0#v=onepage&q&f=false](https://books.google.co.in/books?id=0fl1pKtaghAC&printsec=frontcover&source=gbs_ge_summary_r&cad=0#v=onepage&q&f=false)

<https://engfac.cooper.edu/pages/tzavelis/uploads/Vibration%20Theory.pdf>

*THANK YOU...*

