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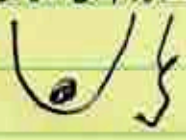
WAVES AND STABILITY

(1) IN DERIVING THE DISPERSION RELATION FOR WAVES WE HAVE ONLY LOOKED AT PURE WAVE SOLUTION SO FAR, IE $\omega^2 > 0$ SO ω IS A REAL NUMBER

(2) HOWEVER, TAKING INTO ACCOUNT DISSIPATIVE TERMS LIKE RESISTIVITY AND VISCOSITY ONE FINDS THAT WAVES WILL DAMP, THAT IS ω BECOMES A COMPLEX NUMBER, AND $i\omega$ HAS A NEGATIVE REAL COMPONENT, I.E $i\omega = i\omega' - \alpha$ (ω' AND α REAL)

(3) IN SOME CASES, FOR SO-CALLED UNSTABLE MAGNETIC CONFIGURATIONS ONE WILL FIND $\omega^2 < 0$, ω PURELY IMAGINARY, AND ONE SOLUTION FOR $i\omega$ IS REAL AND POSITIVE: REAL INSTABILITY, THE SOLUTION RUNS AWAY FROM THE EQUILIBRIUM, E.G. A BALL ON TOP OF A MOUNTAIN $\Rightarrow$ 

{STABILITY =  }

(4) AND IN SOME CASES ω IS A COMPLEX NUMBER WITH A POSITIVE REAL COMPONENT, A GROWING INSTABILITY

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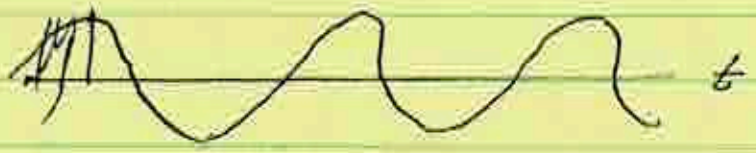
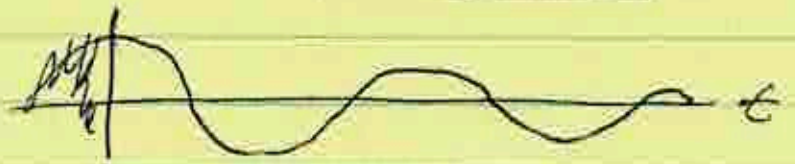
(5) SO, FIVE CASES WITH REGIMES TO STABILITY

1. PURE WAVES: ω = REAL

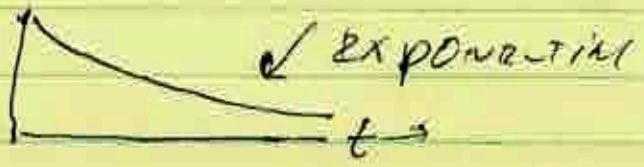


2. DAMPED WAVES, CALLED <u>OVERSTABILITY</u>

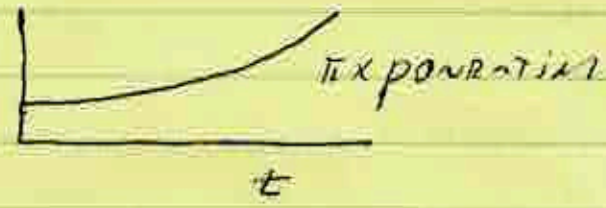


(E.g. hitting a piano string)

3. STABILITY: $i\omega < 0$ (REAL)



4. INSTABILITY: $i\omega > 0$ AND REAL



5. UNSTABLE OSCILLATION, AMPLITUDE GROWS