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HOW TO USE THE APPROXIMATE LINEAR SYSTEM DISTRIBUTION MODEL IN PENDULUM OCSILATOR (SYSTEM ANALYSIS AND CONTROL DESIGN IN OLD CLOCK TOWER WATCH): A MANUALLY SIMULTION PROCESS

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ABSTRACT

In this theory we see the behaviour of pendulum ocsillation. And see how the old scintist observe the clock watch time effectively. Here we use to calculate the highest angle amplitude to using the approximate linear distribution system with manual simulation system to find out the correct time period by clock watch.

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INTRODUCTION

Linear approximation metod is more use in control system. We know that our all control system are non-linear and curvilinear but some where we give a linear or steady state values . In simulation process or sofware we take all the steady state or linear state to solve our hypothesis and convert it to a practical control system.This research paper shows that how we utilize the nonlinear motion to linear motion to convert the actual time period from the clock tower watch. Here in this table the obsevation is very less therefore we simulate the manually. But in automobile and air tarafic control system the data are more than millions. The designer take the appropriate values from software and graphs to design the control system

Theory

In clock tower watch there are a string whose length is L which are rigid with a mass M . these string moves to and fro motion that's called oscillation. This one oscilation give a time period T . For calculating the time period we know the formula which are given below.

The watch designer adjusted the lengh for time period 1 sec. we fill find as by hit and trail method it will becomes 25 cm long. Where g is acceleration due to gravity. The figure are oscilating pendulum are given below. Here the horizontal or rigid line is vertical while the string line or vertical line is horizentol becasue the θ angle come from vertical strings.

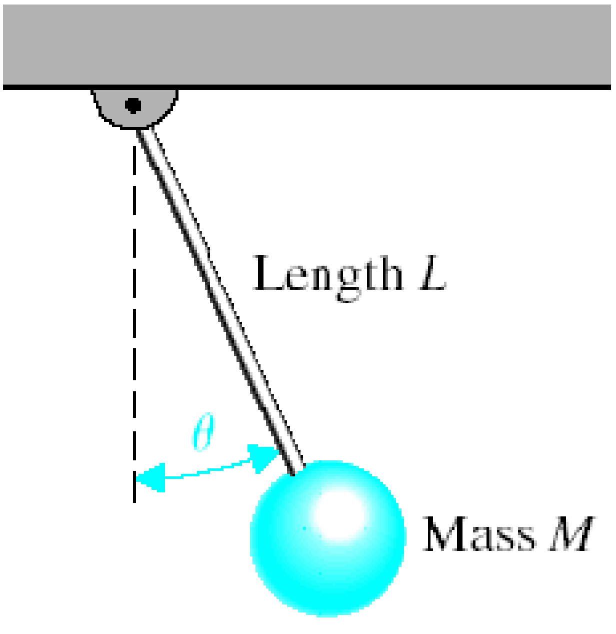


Figure 1. Pendulum ocsilator clock watch

T (Time period) = $2\pi\ \sqrt{L/g}$
For L= 25 cm = 0.25 m, g= 9.8 m/s^2
T = 2X $\pi\sqrt{0.25}/9.8$
T= 1.0034 sec=1.00 sec

For one oscillation the time period (T)1.00 sec . for design the clock tower watch the following assumption are made . These are given below

M= 200 gm. = 0.2kg.

L= 25 cm= 0.25 m

and θ_0 = 0 Degree

and θ = - π /2 to + π/2 (the positive maximum and negative maximum angle -90 degree to + 90 degree) for time period T = 1sec we find out the maximum linear amplitude of the oscillation.

Therefore from figure there are three tension on the string are develop these are resolving the T_o act on only vertical direction due to rigidity of the string there is no movement of string therefore T_o is given below (it become always zero because θ_0 is zero due to no movement of string)

T_o = M g L Sin (θ_0) = 0.2 X 9.8 X 0.25 Sin 0 =0

Another tension T1 and T2 is develop due to angle θ in vertical and horizontal direction direction (resolving the forces in vertical and horizontal direction) these force are

$T_1(\theta)$ = M g L sin(θ) in vertical direction

In horizontal direction there are two tension are join together and becomes equal to $T_2(\theta)$. One without movement of the string says T_o and another is movement of the string say a due to the angle θ_0 these are given below

$T_2(\theta)$ = M g L Cos((θ_0)(θ- θ_0))+ T_o

These formulas given appropriate values to find out the design analysis of a clock watch tower. Using this formula we develop a table given below and find out the approximate linear system distribution (movement of clock) which give the accurate vale of the clock (Time period T = 1 sec) using the graph and simulate in table by approximate linear hypothesis we give the accurate angular movement (θ) of the clock tower watch.

Some sample calculation are given below

$T_{o\,=}$ M g L sin(θ_0) = 0.2 X 9.8 X 0.25 X sin 0= 0.49X0= 0

$T_1(\theta)$ = M g L sin(θ)

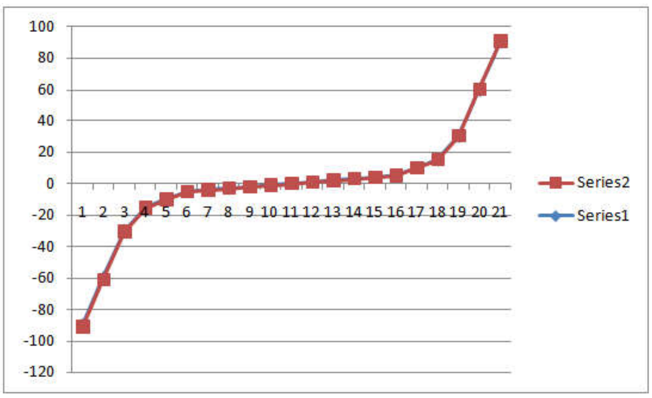
T_1(-60) =0.2X9.8X0.25Xsin(-60)= 0.49X (-0.8660254038) = -0.4244

$T_2(\theta)$ = M g L Cos((θ_0)(θ- θ_0))+ T_o = 0.2X 9.8X0.25X Cos((0)(-60-0))+ 0 = 0.049 Cos (0) = 0.49

According to these calculation we find out the table given below

Table 1. Observation(Pendulum oscillation) of Angles θ and Ratio of tensions $T_1(\theta)/T_2(\theta)$

S. No.	θ Deg	$T_1(\theta)$	$T_2(\theta)$	$T_1(\theta)/T_2(\theta)$	T_o
1	-90	-0.49	0.49	-1.0	0
2	-60	-0.4244	0.49	-0.866	0
3	-30	-0.245	0.49	-0.5	0
4	-15	-0.1268	0.49	-0.259	0
5	-10	-0.0851	0.49	-0.17365	0
6	-5	-0.04271	0.49	-0.0872	0
7	-4	-0.03418	0.49	-0.0697	0
8	-3	-0.02565	0.49	-0.05234	0
9	-2	-0.0171	0.49	-0.0349	0
10	-1	-0.00855	0.49	-0.017453	0
11	-0.5	-0.004276	0.49	-0.00873	0
12	0	0	0.49	0	0
13	0.5	0.004276	0.49	0.00873	0
14	1	0. 00855	0.49	0.017453	0
15	2	0.0171	0.49	0.0349	0
16	3	0.02565	0.49	0.05234	0
17	4	0.03418	0.49	0.0697	0
18	5	0.04271	0.49	0.0872	0
19	10	0.0851	0.49	0.17365	0
20	15	0.1268	0.49	0.259	0
21	30	0.245	0.49	0.5	0
22	60	0.4244	0.49	0.866	0
23	90	0.49	0.49	1.0	0



For Notation X- axis ratio of tension $T_1(\theta)/T_2(\theta)$; Y –axis pendulum oscillation angle θ Deg.

Figure 2. Pendulum oscillation angle θ Deg. vs Ratio of Tensions $T_1(\theta)/T_2(\theta)$

From figure we see that linear approximation from SR. NO. (6 to 17) the degree are -5^0 to $+4^0$

RESULTS

From table and Graphs we find that the oscillation of pendulum is in between -5^0 to $+5^0$ because the pendulum is always move in one revolution for angular amplitude is same in negative as well as positive direction. There for using linear approximation method we select the oscillation of pendulum is in between -5^0 to $+5^0$ for time period T equal to one.

Conclusion

We find out the following conclusion from here

1- The old scientist know very well the control system analogy

2- Using the simulation process we develop any control system for our use and also repair the old clock tower watch very low cost.

3- Using the approximate linear system distribution system is effectively use any control system device

Future scope- These linear distribution is effectively use in automobile control as well all the dynamic control system where we want steady state system.

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