Team Control Number

201906177

Problem Chosen

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ShuWei Cup

Summary

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keyword: sweet spot; corked bat; coefficient of restitution;

Contents

1 Introduction

1.1 Background

1.2 Work

2 Problem Analysis

Analysis of task one Make reasonable predictions of the aging trend of China and the medical needs of the residents according to the data of residents' income, age structure of the population and the economic development level etc. in the relevant statistical analysis data of the National Bureau of Statistic. According to the relevant data from 2009 to 2018 in the National Bureau of statistics, the group first selects appropriate indicators and then establishes a grey prediction model to predict and analyze the population aging trend and residents' medical needs of the epidemic in 2009-2018. Then, through the Markov model, the data from 2009-2018 simulates the distribution of residual in each interval and calculates the expectation of the predicted residual in 2010-2019 Value. Finally, the prediction results and residual expectation are made to be different, and the inherent deviation of traditional grey prediction is corrected. Through the combination of the two models, the goal of scientific prediction of the future development of population aging and the trend of residents' medical needs is achieved. Its thought flow chart is shown in Figure **??** :

Analysis of task two

Analysis of task three The question three ask us to propose a common queuing theory method and figure its related optimal queuing for this kind of queuing problem.Via refering to the operational mode of the real world hospital, we choose to adopt the $M/M/c/\infty$ model as the required theory. Then we acquire the hospital statistics and abstract the data into the parameter in model. Finally, to get the social cost to be lowest, we manage to find the optimized systems design for the queuing model.

Analysis of task four

Analysis of task five

3 Symbol and Assumptions

3.1 Symbol Description

symbols	definitions
v_i	velocity of ball before collision
v_f	velocity of ball after collision
V_f	velocity of bat after collision
S	the shear modulus the bat
Y	Young¡¯s modulus of the bat

3.2 Fundamental assumptions

1. The hourly wage of patient could be considered as the cost dissipated in queuing. And the hourly wage of doctor could be seen as the cost of cost of service.

4 Establishment and solution of the model

4.1 The model of Problem 1

4.2 solution of the model 1

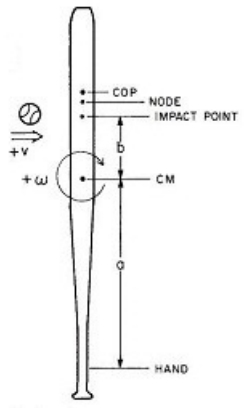

Figure 1: location of point

$$m \cdot v_i = m \cdot v_f + M \cdot V_f \tag{1}$$

$$b \cdot m \cdot v_i + I \cdot \omega_i = b \cdot m \cdot v_f + I \cdot \omega_f \tag{2}$$

$$e_0 \cdot (v_i - \omega_i \cdot b) = V_f + \omega_f \cdot b - v_f \tag{3}$$

4.3 Conclusion

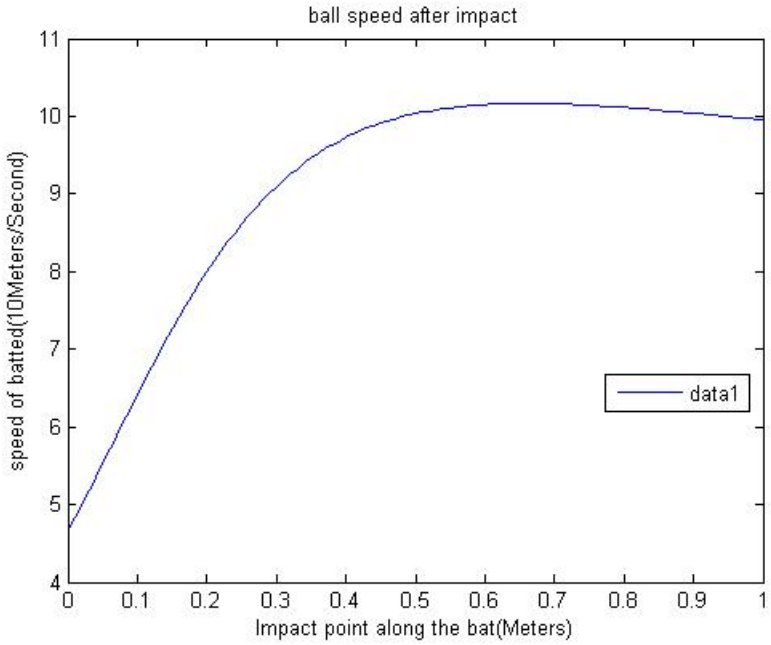

Figure 2: final velocity v_f varies by impact point location b

4.4 The model of Problem 2

4.5 The model of Problem 3

4.6 solution of the model 3

4.7 The model of Problem 4

5 Sensitivity Analysis

6 Strengths and Weaknesses

6.1 Strengths

1. Vibration of bat is taken into account so that the accuracy of the model can be fairly good.

2. Physical explanation is put forward besides the model for a better understanding of the collision process.

3. Figures are used for explanation of the problem,thus making it more intuitive and easier to understand.

6.2 Weaknesses

1. The ball is actually nonlinear when deformation of the ball go beyond a certain limit.The approximation of linear model turned to be flawed when the force applied on the ball become very large.

2. Effective coefficient of restitution can not be calculated accurately.This affect the accuracy of the result of the model.

7 Conclusion

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