

2010~2011 剑桥高中系统动力学小组活动报告

- 参加教师:** 韩维萍、葛洲、张晓凤、李静雯、陈静
- 参加学生:** 肖涵等约 100 人
- 活动时间:** 2010~2011 学年课余时间。
- 活动形式:** 教师授课、小组讨论、调查研究、撰写论文。
- 取得成果:** 参会论文 (见下页)



Exercise in application of the Nanjing Olympic Sports Center running by 2nd Youth Olympic

Fanjia Kong & Shiyun Hu & Haofan Lu

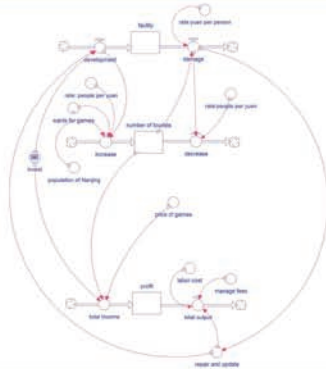
● Abstract

In 2014, the second Youth Olympic Games will be held in Nanjing. We may try to solve a question that is to use the least money to encourage most people to exercise, by finding the relationship between the running of the Nanjing Olympic Sports Center (the Youth Olympic venue) and the number of visitors.

● Basic part:

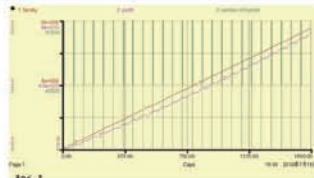
It shows the daily running of the Nanjing Olympic Sports Center
Time period--from now to the beginning of game

■ The completed model:



■ Analysis the model:

- There are three variables involved in the model: value of facilities, number of tourists and the profit.
- The price of ticket does not change.
- The value of facilities is the difference between development and damage. Developments are made up with investment and retain profit. Damage is the product of the number of tourists and damage rate (yuan per person).
- The development of facilities and Nanjingese's want may affect the number of tourists.
- The total income is the sum of investment and the total ticket price. The total output is the sum of labor cost, repair and update and manage fee.



Analysis the figures:

When the investment is 5000000yuan, It attracts many visitors to do exercise. We can know the number of visitor changes frequently with the increasing on the development of facilities. When the number of visitors increases slowly, the total profit increases as well.

■ Conclusion:

From these data we believe that there will be more visitors if government invests more. When the government invests much more on the development of facilities, many more visitors are attracted to go to the stadium. It is easy to catch the goal which to encourage the most visitors.

● Extension:

It shows the specialist running of the Nanjing Olympic Sports Center
Time period--the game time

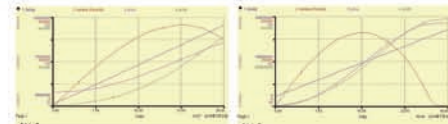
■ The completed model:

A completed version of our model



■ Analysis the model:

- There are still three main variables involved in the model. However, when the games are holding, the number may increase rapidly, so the owner may consider increasing the ticket price to gain more profit. Thus price of ticket is a variable in the extension. The price will increase a certain value when the number of tourists increases 100000.
- The number of tourists may decrease when the price of ticket get too high.
- The price of ticket increases when the number of tourists increases too much.
- The value of facilities and the total profit are the same as basic part.



■ Analysis the figures:

- When the investment is 3000000yuan, the number of visitors increases with the growth of the value of facilities. However, when the number of tourists gets the top, it has a trend to fall because the ticket price increases too much.
- When the investment is 5000000yuan, the number of tourists increases rapidly. This leads to increasing of ticket price and profit again. When number of tourists begins to fall, this two variables will increase more slowly.

■ Conclusion:

- In all, more investment will attract more visitors; more visitors will cause the rapid growth of ticket price and total profit. However, if the ticket price is too high, this will decrease the number of tourist. At that time may consider less increase for the ticket price to guarantee the number of tourists.



Exercise in application of pests, pesticides and soil on rice growth

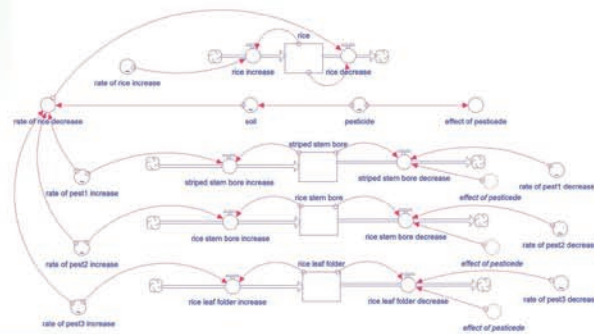
Jie Fu & Zhongqin Gan & Lun Jin

● Background:

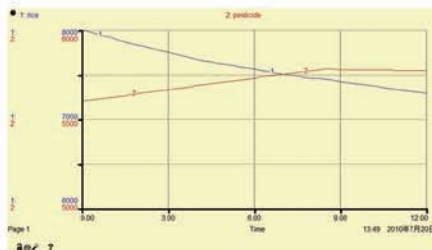
Pests are unavoidable during the growth of rice. Spraying pesticides is the major ways to inhibit the reproduction of pests. First of all, our model seeks to demonstrate the real-life situation based on the system dynamics, and hence understand the impact of pest, predator, pesticide and soil on rice growth and their inter-relationships.

● Analysis:

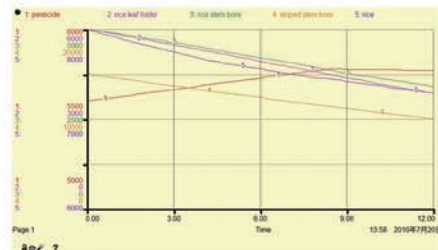
The rice yield has a direct proportion to the number of pest. Consequently, it results the raise of the application amount of pesticides. Nevertheless, overuse of pesticides will contribute to devastation of soil fertility, furthermore, which can cut down the harvest of crops in the long term.



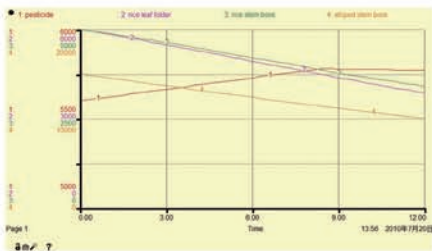
● Statistics & Diagrams



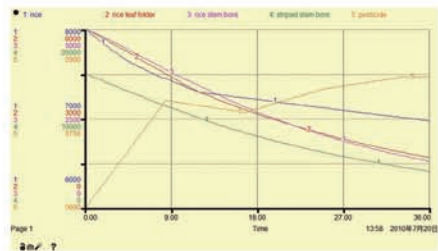
The quantity of rice decreases because of the overused pesticides (one year).



The quantity of rice and pests decreases at the same time because of the overused pesticides (one year).



The quantity of pests decreases because of the overused pesticides (one year).



The quantity of rice and pests decreases at the same time because of the overused pesticides (three year).

● Expansion:

Besides pests, pesticides and soil, there are a lot of other factors that could affect the growth of rice. For example, insects are another significant factor and the climate also cannot be ignored. These make the problem much more complicated and we are committing finding out their inter-relationship based on the system dynamics.

● Conclusion:

Throughout the study on system dynamics, we urge that high technology and more advanced methods to achieve the balance and obtain long-term benefits. Green and healthy life is the best wishes for everyone.





Exercise in application of Accumulation Of The Cars In The Crossroad Using a System Dynamics Model

HAN XIAO

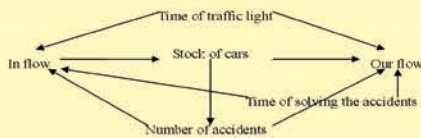
● Abstract

Traffic jam is a common problem that we meet in the daily life. Jams always cause poor transport facilities. This paper seeks to simulate real-life situation in a system dynamics model, and hence find out the causes of the jam, also, to find out the solution. Finally, we will evaluate the limitation of the systems and some parts of the model which is inconsistent with the facts. The paper will help us better understand and to state the complex traffic jam into a systematic and dynamic form.

Traffic jams are caused by many reasons, such as: the time of red lights, the time of solving the accidents. By changing the variable quantity, the stock of cars changes a lot. So, we will use model to investigate various factors that contribute to or alleviate congestion and examine the changing on time to reduce the stock of cars.

● The simplified model

A simplified version of our model

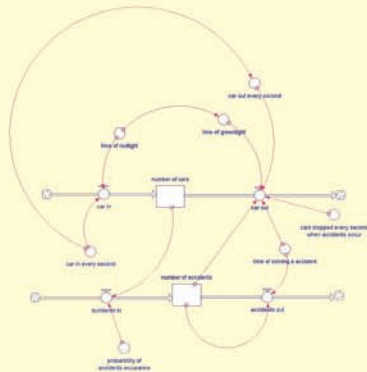


Show you the minor relationship between the most important elements.

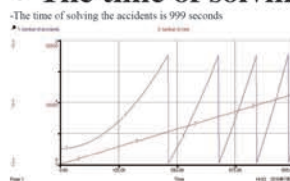
- ← The rate of car flow is set as a constant quantity.
- ← The car inflow represents the number of cars getting into the traffic lane
- ← The car outflow represents the number of cars getting into the traffic lane
- ← The stock of cars is the number of cars stimulating in the crossroad.

● Completed model and the data

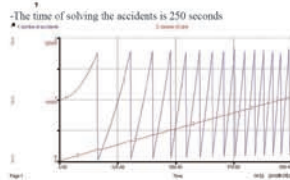
stock of cars	Initial value=50
increase	Car in every second at normal*time of red traffic light
decrease	Car out per second at normal*time of green traffic light number of accidents*time of solving an accident*cars stopped one second when accidents occur
number of accidents in	property of accidents occurring * number of cars
number of accidents out	if number of accidents>time of solving an accident * 0.007 then number of accidents else 0
Car in per second	0.5
Car out per second	0.5
Probability of accident occurrences	0.00001
Time of solving an accident	999
Time of green traffic light	45
Time of red traffic light	45



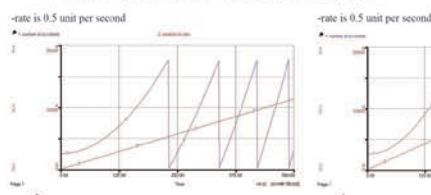
● The time of solving the accidents



Conclusion
Cars stock and quantity of accidents decrease with the decrease of time of solving accidents. If efficiency of solving accidents can increase, the cars stopped when accidents happen will decrease, this can reduce traffic congestions.



● The rate of cars in/out



Conclusion
The width of the road can not fundamentally solve the problem of the car stock, but, this tells us the rate of car in/out is the main problem, which is affected by many reasons (for example, the quantity of cars in the city).

The further study of this paper hasn't finished, because many factors should be included into this systems, and the systems will be very complicated. The question might be completed when I learn more about system-dynamic study.



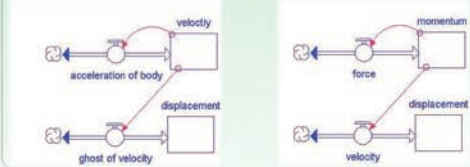
Systems Thinking in Physics & Mathematics Teaching in High School

Zhou Ge, Xiaofeng Zhang

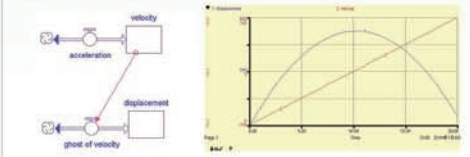
1. When the systems thinking and system dynamics are involved in the high school teaching, more benefits are coming out. Students can do further study and deal with complex problems through practice, analyse, conjecture, simulate and test by the computers. Here are some examples in teaching in high school.



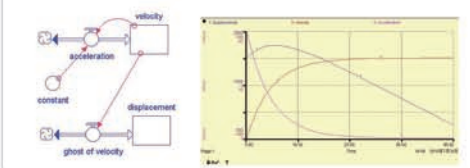
2. The System Dynamics Analysis of falling bodies' motion with air resistance



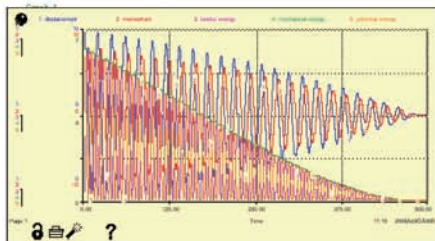
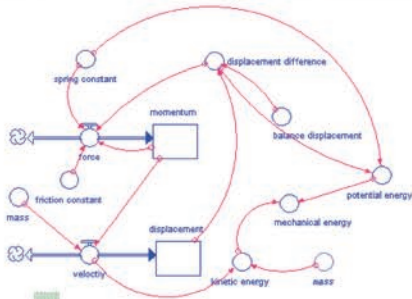
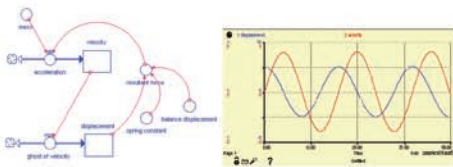
3. The System Dynamics Analysis of Vertical Upwards Projectile Motion



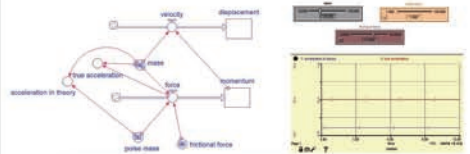
4. The System Dynamics Analysis of Vertical Upwards Projectile Motion with air resistance.



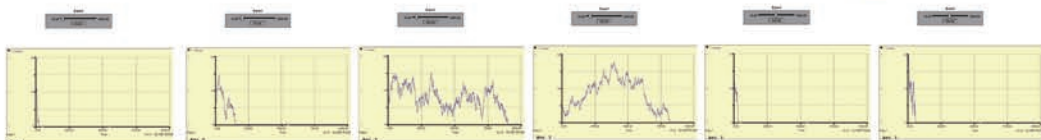
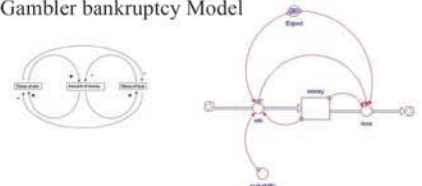
5. The System Dynamics Analysis of simple harmonic motion



6. System dynamics analysis of experimental data of Newton's Second Law



7. Gambler bankruptcy Model



2. 获奖证书



2010年7月同学论文在韩国首尔第28届国际系统动力学大会上获得最佳 poster。

3. 花絮



2010年7月，和南师附中老师和学生一起参加28届国际系统动力学大会



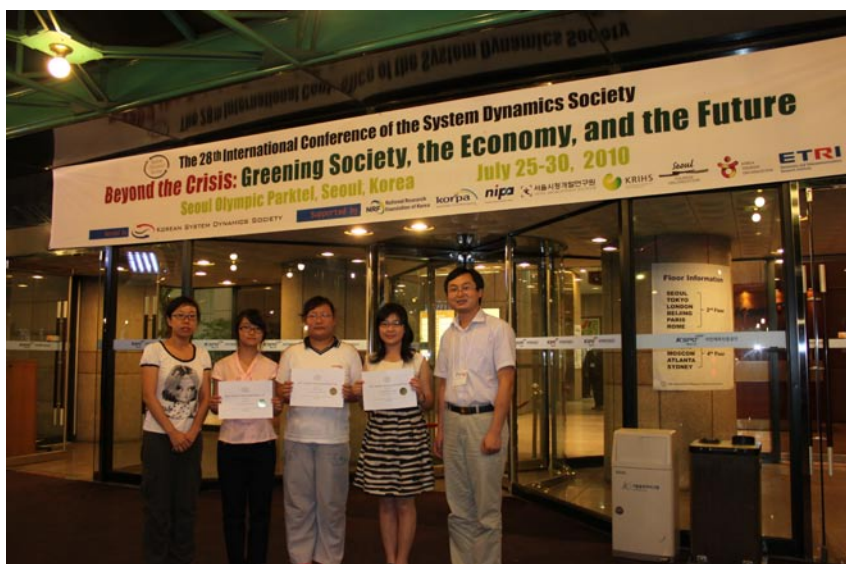
2010年7月，在28届国际系统动力学大会上，与大会主席的合影。



2010年7月，在28届国际系统动力学大会上，与参会的美国学者的合影。



2010年7月，在28届国际系统动力学大会上，大会主席为获奖同学颁奖。



2010年7月，老师和同学参加28届国际系统动力学大会。



2010年7月，在28届国际系统动力学大会上，同学与参会的学者的合影。



2010年7月，在28届国际系统动力学大会上，同学与参会的学者的合影。