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КУРСОВАЯ РАБОТА

Вариант
по дисциплине «Вычислительная математика»

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1.Текст программы

```
#include <fstream>
#include "fmin.h"
#include <math.h>
#include <iomanip>
#include <iostream>
#include <fstream>
#include "quanc8.h"
#include "rkf45.h"
using namespace std;
#define ndim 40
#define M_PI 3.16159265358979323846
#define INDX(i, j)  (i) * ndim + (j)
double func(double x)
{
	return x*x - tan(M_PI*x/3);
}
double intFunc(double x) {
	return pow(x - pow(x,3), 0.5);
}
void MyFunc(float t,  float *y, float *dy)
{
	double ti;
	double errest, flag;
	int col;
	quanc8(intFunc, 0, 0.5, 0.0001, 0.0001, &ti, &errest, &col, &flag);
	ti *= 0.4493982;

	double omega0;
	double Error;
	double TOL=1e-6;
	int flagMin;
	omega0 = 1.142206 * fmin(0, 10, func, TOL, Error, flagMin);
	double mu = 0.1;
    dy[0]=(y[1]*y[1]-y[0])/ti;
	dy[1]=y[2];
	dy[2]=2*mu*(dy[1] - (y[0]*dy[1] + y[1]*dy[0])) - pow(omega0, 2)*y[1];
	return;
}
int main ()
{
	ofstream out("out.txt");
	double A, B, C;
	double m[ndim * ndim];
	double cond;
	int ipvt[3];
	int workFlag;
	double b[3] = {50, -30, -35};
	m[INDX(0,0)] = 46;  m[INDX(0,1)] = -24; m[INDX(0,2)] = -42;
	m[INDX(1,0)] = -24;  m[INDX(1,1)] = 16; m[INDX(1,2)] = 18;
	m[INDX(2,0)] = -42;  m[INDX(2,1)] = 18; m[INDX(2,2)] = 49;
	decomp(3, ndim, m, &cond, ipvt, &workFlag);
	solve(3, ndim, m, b, ipvt);
	A = b[0]; B = b[1]; C = b[2];

	double T = 10;
	float y[3];
	y[0] = C; y[1] = A; y[2] = B;
	float RE = 1e-6;
	float AE = 1e-6;
	int iflag = 1;
	int iwork[ 50 ];
	float work[ 50 ];
	float t = 0, tout = 0;
```

```
        for (tout =0; tout <= T; tout+=0.2) {
               RKF45(MyFunc, 3, y, &t, &tout, &RE, &AE, &iflag, work, iwork);
               cout << "t = " << t << " z = " << y[0] <<
                      " V = " << y[1] << " V' =  "<< y[2] << " flag = " << iflag << endl; }

        return 0;
}
```

2.Результаты тестирования

```
t = 0 z = 1 V = 2 V' =  -2.26979e-015 flag = 2
t = 0.2 z = 3.04244 V = 1.68295 V' =  -2.65804 flag = 2
t = 0.4 z = 1.8509 V = 1.04616 V' =  -3.59121 flag = 2
t = 0.6 z = 0.544467 V = 0.272828 V' =  -4.0865 flag = 2
t = 0.8 z = 0.178156 V = -0.554352 V' =  -4.05494 flag = 2
t = 1 z = 1.00294 V = -1.2786 V' =  -2.98626 flag = 2
t = 1.2 z = 2.29258 V = -1.68273 V' =  -0.968415 flag = 2
t = 1.4 z = 2.82625 V = -1.6711 V' =  0.994559 flag = 2
t = 1.6 z = 2.25202 V = -1.3301 V' =  2.30898 flag = 2
t = 1.8 z = 1.15716 V = -0.780949 V' =  3.11808 flag = 2
t = 2 z = 0.28713 V = -0.107156 V' =  3.55011 flag = 2
t = 2.2 z = 0.181053 V = 0.600907 V' =  3.40325 flag = 2
t = 2.4 z = 0.921285 V = 1.19359 V' =  2.36744 flag = 2
t = 2.6 z = 1.87938 V = 1.50055 V' =  0.646103 flag = 2
t = 2.8 z = 2.19504 V = 1.45723 V' =  -1.01352 flag = 2
t = 3 z = 1.67598 V = 1.12858 V' =  -2.19002 flag = 2
t = 3.2 z = 0.796054 V = 0.609865 V' =  -2.9343 flag = 2
t = 3.4 z = 0.167012 V = -0.019015 V' =  -3.27726 flag = 2
t = 3.6 z = 0.218254 V = -0.66098 V' =  -3.01752 flag = 2
t = 3.8 z = 0.931933 V = -1.17116 V' =  -1.95373 flag = 2
t = 4 z = 1.70672 V = -1.40635 V' =  -0.36368 flag = 2
t = 4.2 z = 1.86847 V = -1.32464 V' =  1.12123 flag = 2
t = 4.4 z = 1.34338 V = -0.986747 V' =  2.18573 flag = 2
t = 4.6 z = 0.576817 V = -0.476548 V' =  2.85423 flag = 2
t = 4.8 z = 0.106158 V = 0.127545 V' =  3.10423 flag = 2
t = 5 z = 0.273849 V = 0.723769 V' =  2.73513 flag = 2
t = 5.2 z = 0.975125 V = 1.17102 V' =  1.6259 flag = 2
t = 5.4 z = 1.61776 V = 1.34646 V' =  0.1111 flag = 2
t = 5.6 z = 1.65666 V = 1.22651 V' =  -1.25248 flag = 2
t = 5.8 z = 1.11229 V = 0.872156 V' =  -2.22501 flag = 2
t = 6 z = 0.424302 V = 0.361493 V' =  -2.81906 flag = 2
t = 6.2 z = 0.0787037 V = -0.226714 V' =  -2.97571 flag = 2
t = 6.4 z = 0.342399 V = -0.786316 V' =  -2.49951 flag = 2
t = 6.6 z = 1.03253 V = -1.1798 V' =  -1.3403 flag = 2
t = 6.8 z = 1.56391 V = -1.30194 V' =  0.121837 flag = 2
t = 7 z = 1.49744 V = -1.14491 V' =  1.39016 flag = 2
t = 7.2 z = 0.932894 V = -0.771322 V' =  2.28317 flag = 2
t = 7.4 z = 0.310695 V = -0.256142 V' =  2.80444 flag = 2
t = 7.6 z = 0.0747609 V = 0.320165 V' =  2.86667 flag = 2
t = 7.8 z = 0.421106 V = 0.847154 V' =  2.28516 flag = 2
t = 8 z = 1.09551 V = 1.19137 V' =  1.07749 flag = 2
t = 8.2 z = 1.52437 V = 1.26408 V' =  -0.340771 flag = 2
t = 8.4 z = 1.36436 V = 1.07135 V' =  -1.52784 flag = 2
t = 8.6 z = 0.783611 V = 0.677609 V' =  -2.34903 flag = 2
t = 8.8 z = 0.223854 V = 0.156253 V' =  -2.79786 flag = 2
t = 9 z = 0.0898094 V = -0.409553 V' =  -2.76372 flag = 2
t = 9.2 z = 0.507817 V = -0.905257 V' =  -2.079 flag = 2
t = 9.4 z = 1.15875 V = -1.20239 V' =  -0.827983 flag = 2
t = 9.6 z = 1.48855 V = -1.22828 V' =  0.548617 flag = 2
t = 9.8 z = 1.24457 V = -1.00127 V' =  1.66252 flag = 2
t = 10 z = 0.654104 V = -0.58741 V' =  2.41653 flag = 2
```

График зависимости V от t

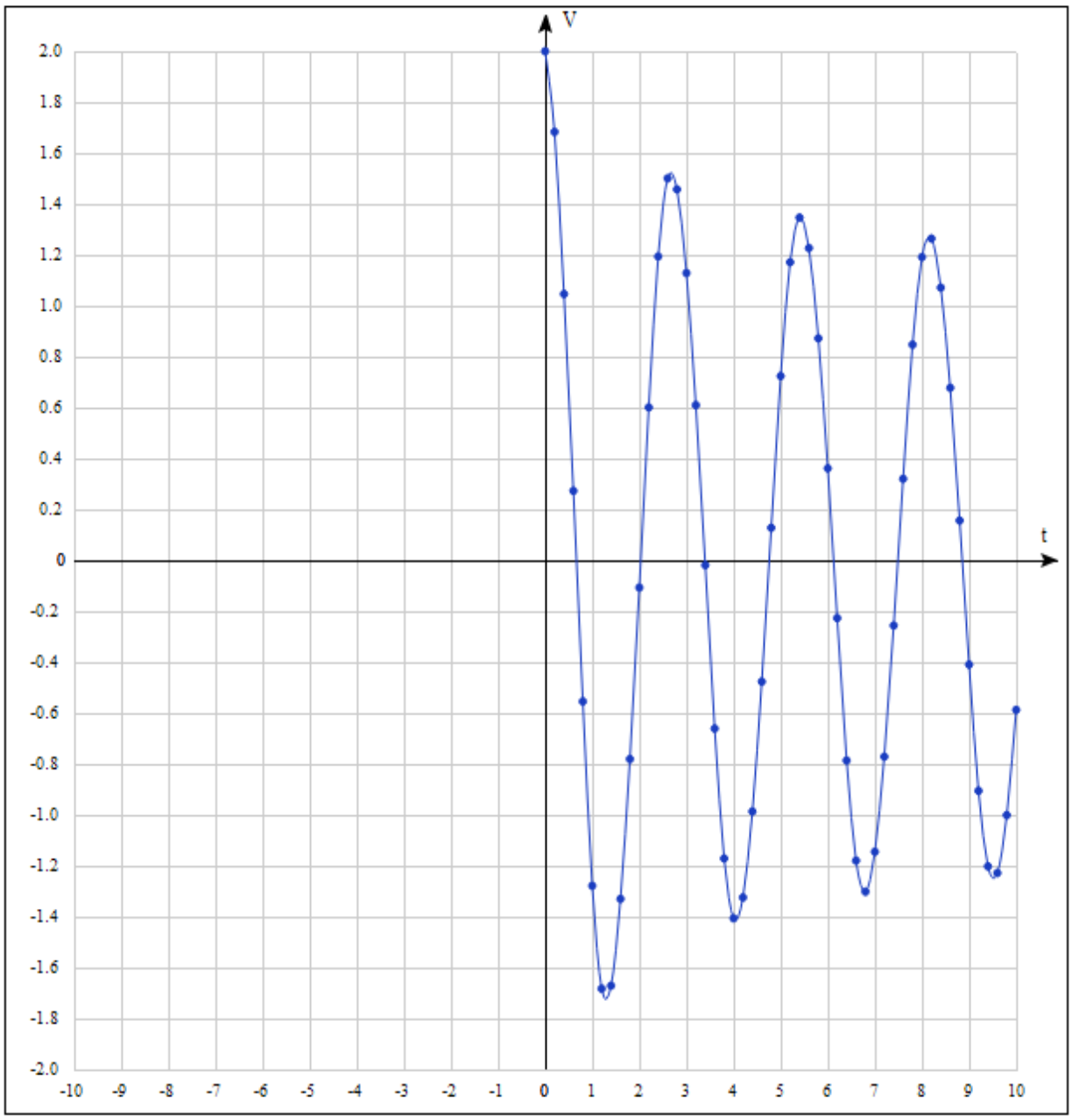
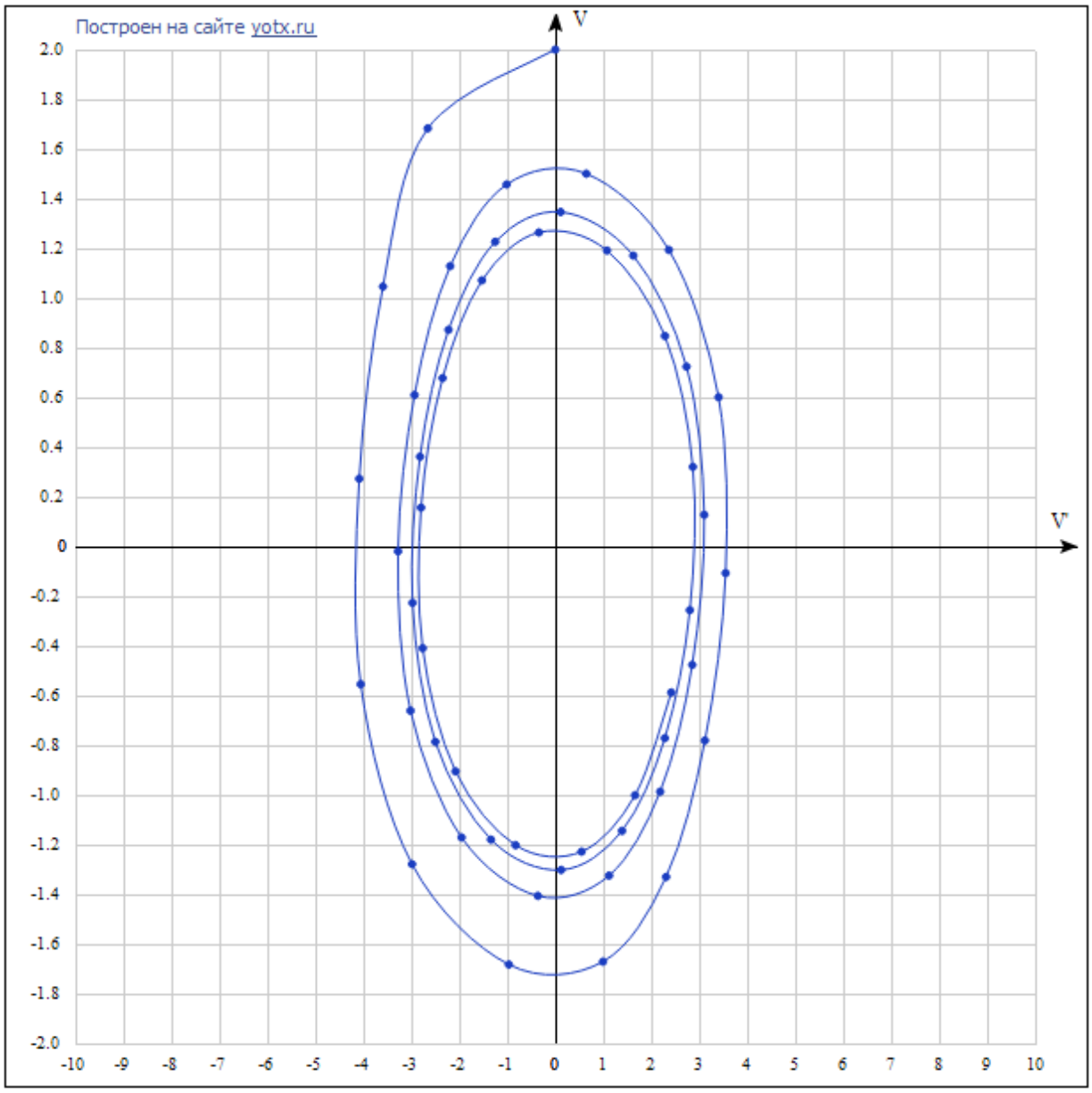


График зависимости V от V'



3.Выводы

По результатам данной курсовой работы были построены графики зависимости *V* от *t* и *V* от *V'*.

Погрешность *omega0*, через подпрограмму QUANC8 составляет 7 знаков после запятой. Погрешность x*, через нахождения наименьшего положительного корня функции, составляет 6 знаков после запятой. Из этого следует, что эти погрешности не влияют на конечный результат, так как относительная и абсолютная погрешность подпрограммы RKF45, которая непосредственно решает систему уравнений, дают точность в 6 и 7 знаков соответственно.