// Test4.cpp : Defines the entry point for the console application.

//

#include "stdafx.h"

int \_tmain(int argc, \_TCHAR\* argv[])

{

//In this program you must keep all units positive except for dLA and dLH (including angular velocities):

/\*L\_L\_0 is the max angle we should ever reach for LA, and similar for L\_R\_0. L1 and L2 are spring lengths

at a given point/time and L1not and L2not are there natural lengths:\*/

float LA, LH, L\_L\_0, L\_R\_0, L1, L2, L1not, L2not, V, epsilon=0, /\*I think epsilon must be zero for the simulation\*/, dLA, dLH, Ia, dt, wh, wa, R, F,Z, Ih, tow, eta, angle, Work,k,r, d;

bool value=true;

while(value)

{

//Basic calculations:

LA=LA+dLA;

LH=LH+dLH;

//Force and work equations here.

Work=(V\*V/Z)\*eta\*dt;

if(L1<L1not)

F=k\*(L2-L2not)\*sqrt(r\*r+d\*d)\*sin(LA)/L2;

if(L2<L2not)

F=k(L1-L1not)\*sqrt(r\*r+d\*d)\*sin(arccos((d\*d-r\*r)/(r\*r+d\*d))-LA)/L1;

if((L1>L1not)&&(L2>L1not))

F=abs(k\*(L2-L2not)\*sqrt(r\*r+d\*d)\*sin(LA)/L2-k(L1-L1not)\*sqrt(r\*r+d\*d)\*sin(arccos((r\*r-d\*d)/(r\*r+d\*d))-LA)/L1);

///////////////////////////////////////////////////////////////////////////////////////////////////////////////////////// START OF FIRST CONDITION:

/\*THIS CONDITION ADJUST THE HUB IF LAMBDA GETS TO SMALL OR TOO LARGE:\*/

if(LA>L\_L\_0+epsilon)

{

//This condition should be fine:

V=10;

wh=dLH/dt;

wa=dLA/dt;

dLH=((1/2)\*(wh\*Z\*Ih\*Ia+sqrt(wh\*wh\*Z\*Z\*Ih\*Ih\*Ia\*Ia-Ia\*Ih\*Z\*Z\*R\*R\*F\*F\*dt\*dt-2\*Ia\*Ia\*Ih\*Z\*Z\*dt\*tow\*abs(wh)+2\*Ia\*Ia\*Ih\*Z\*dt\*V\*V\*eta-2\*Ia\*Ia\*Ih\*Z\*Z\*dt\*R\*F\*wh-2\*Ia\*Ia\*Ih\*Z\*Z\*dt\*R\*F\*wa))\*dt/(Ia\*Ih\*Z));

dLA=((1/2)\*(-2\*dLH\*Ia+2\*dt\*Ia\*wh+2\*dt\*Ia\*wa+R\*F\*dt\*dt)/Ia);

wh=dLH/dt;

wa=dLA/dt;

}

if(LA<L\_R\_0-epsilon)

{

V=10;

wh=-wh;//These two equations convert the velocities so that there sign is correct for the dLH and dLA equations below

wa=-wa;

dLH=-((1/2)\*(wh\*Z\*Ih\*Ia+sqrt(wh\*wh\*Z\*Z\*Ih\*Ih\*Ia\*Ia-Ia\*Ih\*Z\*Z\*R\*R\*F\*F\*dt\*dt-2\*Ia\*Ia\*Ih\*Z\*Z\*dt\*tow\*abs(wh)+2\*Ia\*Ia\*Ih\*Z\*dt\*V\*V\*eta-2\*Ia\*Ia\*Ih\*Z\*Z\*dt\*R\*F\*wh-2\*Ia\*Ia\*Ih\*Z\*Z\*dt\*R\*F\*wa))\*dt/(Ia\*Ih\*Z));

dLA=-((1/2)\*(-2\*dLH\*Ia+2\*dt\*Ia\*wh+2\*dt\*Ia\*wa+R\*F\*dt\*dt)/Ia);

wh=dLH/dt;

wa=dLA/dt;

}

///////////////////////////////////////////////////////////////////////////////////////////////////////////////////////// END OF FIRST CONDITION:

//we need to switch these conditions to relating kinetic energy to spring potential:

////////////////////////////////////////////////////////////////////////////////////////////////////////////////////////// START OF SECOND CONDITION:

/\*THESE CONDITIONS SHOULD BE FIEN PROVIDED LH STARTS AT ZERO AT THE BEGINNING OF THE PROGRAM:

WE SHOULD ADD A CONDITION LIKE ANGLE-LH>0 RATHER THAN JUST ANGLE>0: IN THE FUTURE\*/

/\*THIS CONDITION OPERTATES THE ROBOT UNTIL IT IS TIME FOR THE HUB TO STOP AND LET THE ARM SWING PAST A/2:\*/

if((LA>L\_R\_0)&&(angle>0)&&(angle/2-LH>wh\*wh\*Ih/(2\*(tow+F\*R))&&(LH<angle)))

{

V=10;

wh=dLH/dt;

wa=dLA/dt;

dLH=((1/2)\*(wh\*Z\*Ih\*Ia+sqrt(wh\*wh\*Z\*Z\*Ih\*Ih\*Ia\*Ia-Ia\*Ih\*Z\*Z\*R\*R\*F\*F\*dt\*dt-2\*Ia\*Ia\*Ih\*Z\*Z\*dt\*tow\*abs(wh)+2\*Ia\*Ia\*Ih\*Z\*dt\*V\*V\*eta-2\*Ia\*Ia\*Ih\*Z\*Z\*dt\*R\*F\*wh-2\*Ia\*Ia\*Ih\*Z\*Z\*dt\*R\*F\*wa))\*dt/(Ia\*Ih\*Z));

dLA=((1/2)\*(-2\*dLH\*Ia+2\*dt\*Ia\*wh+2\*dt\*Ia\*wa+R\*F\*dt\*dt)/Ia);

wh=dLH/dt;

wa=dLA/dt;

}

if((LA>L\_R\_0)&&(angle>0)&&(LH-angle/2>wh\*wh\*Ih/(2\*(tow+F\*R))&&(LH>angle)))

{

V=10;

wh=-wh;//These two equations convert the velocities so that there sign is correct for the dLH and dLA equations below

wa=-wa;

dLH=-((1/2)\*(wh\*Z\*Ih\*Ia+sqrt(wh\*wh\*Z\*Z\*Ih\*Ih\*Ia\*Ia-Ia\*Ih\*Z\*Z\*R\*R\*F\*F\*dt\*dt-2\*Ia\*Ia\*Ih\*Z\*Z\*dt\*tow\*abs(wh)+2\*Ia\*Ia\*Ih\*Z\*dt\*V\*V\*eta-2\*Ia\*Ia\*Ih\*Z\*Z\*dt\*R\*F\*wh-2\*Ia\*Ia\*Ih\*Z\*Z\*dt\*R\*F\*wa))\*dt/(Ia\*Ih\*Z));

dLA=-((1/2)\*(-2\*dLH\*Ia+2\*dt\*Ia\*wh+2\*dt\*Ia\*wa+R\*F\*dt\*dt)/Ia);

wh=dLH/dt;

wa=dLA/dt;

}

if((LA<L\_L\_0)&&(angle<0)&&(LH-angle/2>wh\*wh\*Ih/(2\*(tow+F\*R)))&&(LH>angle))

{

V=10;

wh=-wh;//These two equations convert the velocities so that there sign is correct for the dLH and dLA equations below

wa=-wa;

dLH=-((1/2)\*(wh\*Z\*Ih\*Ia+sqrt(wh\*wh\*Z\*Z\*Ih\*Ih\*Ia\*Ia-Ia\*Ih\*Z\*Z\*R\*R\*F\*F\*dt\*dt-2\*Ia\*Ia\*Ih\*Z\*Z\*dt\*tow\*abs(wh)+2\*Ia\*Ia\*Ih\*Z\*dt\*V\*V\*eta-2\*Ia\*Ia\*Ih\*Z\*Z\*dt\*R\*F\*wh-2\*Ia\*Ia\*Ih\*Z\*Z\*dt\*R\*F\*wa))\*dt/(Ia\*Ih\*Z));

dLA=-((1/2)\*(-2\*dLH\*Ia+2\*dt\*Ia\*wh+2\*dt\*Ia\*wa+R\*F\*dt\*dt)/Ia);

wh=dLH/dt;

wa=dLA/dt;

}

if((LA<L\_L\_0)&&(angle<0)&&(angle/2-LH>wh\*wh\*Ih/(2\*(tow+F\*R)))&&(LH<angle))

{

V=10;

wh=dLH/dt;

wa=dLA/dt;

dLH=((1/2)\*(wh\*Z\*Ih\*Ia+sqrt(wh\*wh\*Z\*Z\*Ih\*Ih\*Ia\*Ia-Ia\*Ih\*Z\*Z\*R\*R\*F\*F\*dt\*dt-2\*Ia\*Ia\*Ih\*Z\*Z\*dt\*tow\*abs(wh)+2\*Ia\*Ia\*Ih\*Z\*dt\*V\*V\*eta-2\*Ia\*Ia\*Ih\*Z\*Z\*dt\*R\*F\*wh-2\*Ia\*Ia\*Ih\*Z\*Z\*dt\*R\*F\*wa))\*dt/(Ia\*Ih\*Z));

dLA=((1/2)\*(-2\*dLH\*Ia+2\*dt\*Ia\*wh+2\*dt\*Ia\*wa+R\*F\*dt\*dt)/Ia);

wh=dLH/dt;

wa=dLA/dt;

}

//////////////////////////////////////////////////////////////////////////////////////////////////////////////////////////// END OF SECOND CONDITION:

//////////////////////////////////////////////////////////////////////////////////////////////////////////////////////////// START OF THIRD CONDITION:

/\*THIS SECTION OPERATES THE ROBOT WHILE THE VOLTAGE IS ZERO AND THE ARM IS SWINGING ACROSS A/2:\*/

if((LA>L\_R\_0)&&(angle>0)&&(angle/2-LH<=wh\*wh\*Ih/(2\*(tow+F\*R))&&(LH<angle)))

{

V=0;

wh=dLH/dt;

wa=dLA/dt;

dLH=((1/2)\*(wh\*Z\*Ih\*Ia+sqrt(wh\*wh\*Z\*Z\*Ih\*Ih\*Ia\*Ia-Ia\*Ih\*Z\*Z\*R\*R\*F\*F\*dt\*dt-2\*Ia\*Ia\*Ih\*Z\*Z\*dt\*tow\*abs(wh)+2\*Ia\*Ia\*Ih\*Z\*dt\*V\*V\*eta-2\*Ia\*Ia\*Ih\*Z\*Z\*dt\*R\*F\*wh-2\*Ia\*Ia\*Ih\*Z\*Z\*dt\*R\*F\*wa))\*dt/(Ia\*Ih\*Z));

dLA=((1/2)\*(-2\*dLH\*Ia+2\*dt\*Ia\*wh+2\*dt\*Ia\*wa+R\*F\*dt\*dt)/Ia);

wh=dLH/dt;

wa=dLA/dt;

}

if((LA>L\_R\_0)&&(angle>0)&&(LH-angle/2<=wh\*wh\*Ih/(2\*(tow+F\*R))&&(LH>angle)))

{

V=0;

wh=-wh;//These two equations convert the velocities so that there sign is correct for the dLH and dLA equations below

wa=-wa;

dLH=-((1/2)\*(wh\*Z\*Ih\*Ia+sqrt(wh\*wh\*Z\*Z\*Ih\*Ih\*Ia\*Ia-Ia\*Ih\*Z\*Z\*R\*R\*F\*F\*dt\*dt-2\*Ia\*Ia\*Ih\*Z\*Z\*dt\*tow\*abs(wh)+2\*Ia\*Ia\*Ih\*Z\*dt\*V\*V\*eta-2\*Ia\*Ia\*Ih\*Z\*Z\*dt\*R\*F\*wh-2\*Ia\*Ia\*Ih\*Z\*Z\*dt\*R\*F\*wa))\*dt/(Ia\*Ih\*Z));

dLA=-((1/2)\*(-2\*dLH\*Ia+2\*dt\*Ia\*wh+2\*dt\*Ia\*wa+R\*F\*dt\*dt)/Ia);

wh=dLH/dt;

wa=dLA/dt;

}

if((LA<L\_L\_0)&&(angle<0)&&(LH-angle/2<=wh\*wh\*Ih/(2\*(tow+F\*R)))&&(LH>angle))

{

V=0;

wh=-wh;//These two equations convert the velocities so that there sign is correct for the dLH and dLA equations below

wa=-wa;

dLH=-((1/2)\*(wh\*Z\*Ih\*Ia+sqrt(wh\*wh\*Z\*Z\*Ih\*Ih\*Ia\*Ia-Ia\*Ih\*Z\*Z\*R\*R\*F\*F\*dt\*dt-2\*Ia\*Ia\*Ih\*Z\*Z\*dt\*tow\*abs(wh)+2\*Ia\*Ia\*Ih\*Z\*dt\*V\*V\*eta-2\*Ia\*Ia\*Ih\*Z\*Z\*dt\*R\*F\*wh-2\*Ia\*Ia\*Ih\*Z\*Z\*dt\*R\*F\*wa))\*dt/(Ia\*Ih\*Z));

dLA=-((1/2)\*(-2\*dLH\*Ia+2\*dt\*Ia\*wh+2\*dt\*Ia\*wa+R\*F\*dt\*dt)/Ia);

wh=dLH/dt;

wa=dLA/dt;

}

if((LA<L\_L\_0)&&(angle<0)&&(angle/2-LH<=wh\*wh\*Ih/(2\*(tow+F\*R)))&&(LH<angle))

{

V=0;

wh=dLH/dt;

wa=dLA/dt;

dLH=((1/2)\*(wh\*Z\*Ih\*Ia+sqrt(wh\*wh\*Z\*Z\*Ih\*Ih\*Ia\*Ia-Ia\*Ih\*Z\*Z\*R\*R\*F\*F\*dt\*dt-2\*Ia\*Ia\*Ih\*Z\*Z\*dt\*tow\*abs(wh)+2\*Ia\*Ia\*Ih\*Z\*dt\*V\*V\*eta-2\*Ia\*Ia\*Ih\*Z\*Z\*dt\*R\*F\*wh-2\*Ia\*Ia\*Ih\*Z\*Z\*dt\*R\*F\*wa))\*dt/(Ia\*Ih\*Z));

dLA=((1/2)\*(-2\*dLH\*Ia+2\*dt\*Ia\*wh+2\*dt\*Ia\*wa+R\*F\*dt\*dt)/Ia);

wh=dLH/dt;

wa=dLA/dt;

}

/////////////////////////////////////////////////////////////////////////////////////////////////////////////////////////////////// END OF THIRD CONDITION:

///////////////////////////////////////////////////////////////////////////////////////////////////////////////////////////////////START OF FOURTH CONDITION:

/\*THIS CONDITION OPERATES THE ROBOT WHILE IT IS COMING TO A FINAL STOP:\*/

}//ENDS MAIN WHILE LOOP:

return 0;

}