Programming language: C++

Runtime: Microsoft Visual Studio

Completion time: 4 hours (time is for reference only, it is not a limitation; the main thing is - performance quality)

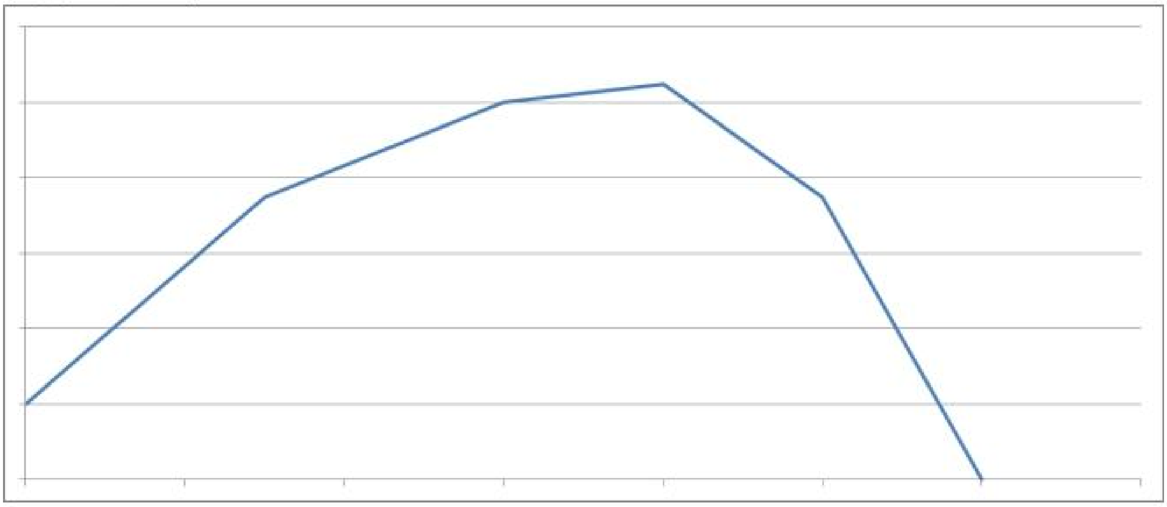
A task:
It is necessary to develop a console application that calculates and displays the time, which will pass from the start of the internal combustion engine to the moment of its overheating, depending on the set ambient temperature. The application must accept console user input ambient temperature in degrees Celsius, and output on the console time to overheat in seconds. Calculate time accurately, analytically necessary, interested in obtaining this time by simulation (of course, in this way time will be calculated with a certain error).

The application should consist of three logical blocks:

1. Simulation of an internal combustion engine

It is required to simulate a change in crankshaft speed and temperature in a simplified way coolant of an unloaded engine over time. Input options:

- Motor moment of inertia **I** (kg*m^2)
- Piecewise linear dependence of the torque **M** generated by the engine on crankshaft rotation speed **V** (torque in N·m, rotation speed in radians/sec):



- Superheat temperature Tsuperheat (°C)
- Coefficient of dependence of heating rate on torque **HM** ($C0/H\cdot m\cdot$sec)
- The coefficient of dependence of the heating rate on the speed of rotation of the crankshaft HV (C0·sec/rad^2)
- The coefficient of dependence of the cooling rate on the temperature of the engine and the ambient environment C (1/sec)

Since the engine is running without load, all the generated torque goes to spin up. crankshaft, and its acceleration is calculated simply: $\boldsymbol{a} = \boldsymbol{M}/\mathbf{I}$

No special engine start logic is required. We believe that at the start it just starts generate torque according to a given schedule starting from zero rotation speed.

Motor heating rate calculated as VH = M × HM + V^2 × HV (°C/sec)
Calculate the cooling rate of the motor as VC = C × (Tenvironment - Tmotor) (°C/sec)

The temperature of the engine before the start must be equal to the ambient temperature. Heating and cooling, calculated by the formulas above, act on the motor constantly, simultaneously and independently of each other.

2. The logic of testing the engine for overheating

It is required to implement a "test stand" that examines the engine supplied to the input. test the stand must turn on the engine, monitor its temperature, and at the time of overheating stop the test and return the time elapsed from the moment of start to overheating.
Engine simulation calculation should not be done in real time. Necessary use model time so that there is no waiting for the results of the program lengthy.

3. Console I/O, setting initial data and running the test

This part of the application contains the entry point, and must provide all I/O to the console, as well as setting all the initial data and starting the engine test. All source data except ambient temperature, must be set in the code or in the configuration file:

I = 10
M = { 20, 75, 100, 105, 75, 0 } with V = { 0. 75, 150, 200, 250, 300 }, respectively
Tsuperheat = 110
HM = 0.01
HV = 0.0001
C=0.1

The ambient temperature is entered by the user from the keyboard, after starting applications.

Criteria for evaluation:

The completed task will be evaluated according to the following criteria:
1) Correctness of work. The application must give the correct result on various input data, there should be no crashes and freezes.
2) Architecture. Ease of expanding functionality: adding new types of engines, in including no internal combustion, new types of tests. Easy to change input test data.
3) Decoration. Code readability, organization of application files and folders.

As a result, you need to send an archive containing the MS Visual Studio project and files source code (or a link to download the archive)