CSE282 Online (30 May 2021, Sunday)

Thermistors are temperature-measuring devices based on the principle that the thermistor material exhibits a change in electrical resistance with a change in temperature. By measuring the resistance of the thermistor material, one can then determine the temperature.

There are two types of thermistors – negative temperature coefficient (NTC) and positive temperature coefficient (PTC) thermistors. For NTCs, the resistance decreases with temperature, while for PTCs, the temperature increases with temperature. It is the NTCs that are generally used for temperature measurement.

But thermistors have a nonlinear output and are valued for a limited range. So, when a thermistor is manufactured, the manufacturer supplies a resistance vs. temperature curve. The curve generally used that gives an accurate representation is given by Steinhart and Hart equation:

$$\frac{1}{T} = a_0 + a_1 \ln(R) + a_3 \{\ln(R)\}^3 \qquad (1)$$

where

T is temperature in Kelvin, and
R is resistance in ohms.
a_0, a_1, a_3 are constants of the calibration curve.

As an example, for an actual thermistor – Part No 10K3A made by Betatherm sensors, the resulting Steinhart-Hart equation is:

$$\frac{1}{T} = 1.129241 \times 10^{-3} + 2.341077 \times 10^{-4} \ln(R) + 8.775468 \times 10^{-8} \{\ln(R)\}^3 \qquad (2)$$

where note that T is in Kelvin and R is in ohms.

For today's online, your job is to find the value of resistance R for a given temperature value of 19^oC for the 10K3A thermistor.

Use bisection method to solve the problem as a solution of a non-linear equation. Add 273.15 to convert the given temperature to Kelvin.