
Table of Contents

| | |
|------------------------------------|---|
| | 1 |
| | 2 |
| INITIALIZATION | 2 |
| | 2 |
| CALCULATIONS | 2 |
| | 3 |
| COMMAND WINDOW OUTPUT | 3 |
| | 6 |
| ACADEMIC INTEGRITY STATEMENT | 6 |

```
function [minRodLength] = PS08_fin_length_koike(rodDiameter,
    thermalConductivity, sourceTemp, ambientTemp)

%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
% ENGR 132
% Program Description
% This program calculates the temperature of a rod which is adjacent
% to a heat source using the infinite fin model. And the function
% will output the minimum length of the rod for the model to be
% probable.
%
% Function Call
% PS08_fin_length_koike(rodDiameter, thermalConductivity, sourceTemp,
    ambientTemp);
%
% Input Arguments
% 1. rodDiameter: the diameter of the given rod
% 2. thermalConductivity: the thermal conductivity of the rod
    depending
%     on its material
% 3. sourceTemp: the temperature of the heat source
% 4. ambientTemp: the temperature of the ambient air
%
% Output Arguments
% 1. minRodLength: the minimum possible rod length for the model
%
% Assignment Information
% Assignment:      PS 08, Problem 2
% Author:         Tomoki Koike, koike@purdue.edu
% Team ID:        002-08
% Contributor:    Name, login@purdue [repeat for each]
% My contributor(s) helped me:
%     [ ] understand the assignment expectations without
%         telling me how they will approach it.
%     [ ] understand different ways to think about a solution
%         without helping me plan my solution.
%     [ ] think through the meaning of a specific error or
%         bug present in my code without looking at my code.
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
```

INITIALIZATION

```
% the array for academic integrity statement
nameArray = "Tomoki Koike";

% the invalid conditions for the input arguments
% rod diameter
invalidRodDiameter = rodDiameter < 0;
% thermal conductivity
invalidThermalConductivity = thermalConductivity < 0;
% heat source temperature
invalidSourceTemp = sourceTemp < 0;
% ambient air temperature
invalidAmbientTemp = ambientTemp < 0;

% the thermal conductivities for each material (W/(m*K))
%AlConductivity = 205;
%CuConductivity = 400;
%stainlessSteelConductivity = 16;

% setting the constants
%rodDiameter = 0.005; %the diameter of the rods (m)
%sourceTemp = 373;    %the source temperature (K)
%ambientTemp = 298;   %the ambient temperature (K)
heatXcoeff = 100;     %the convection heat transaction coefficient (W/
(m^2*K))
perimeter = rodDiameter * pi;
area = pi * (rodDiameter / 2)^2;
m_coeff = sqrt(heatXcoeff * perimeter / area / thermalConductivity);
```

CALCULATIONS

```
% the initialization of the output argument
minRodLength = -1;

%start
if invalidRodDiameter
    fprintf("Error! invalid rod diameter");
elseif invalidThermalConductivity
    fprintf("Error! invalid thermal conductivity");
elseif invalidSourceTemp
    fprintf("Error! invalid heat source temperature");
elseif invalidAmbientTemp
    fprintf("Error! invalid ambient air temperature");
else
    tempX = 1;
    x = 0;
```

```

        while round(tempX) ~= ambientTemp
            x = x + 0.01;
            tempX = ambientTemp + (sourceTemp - ambientTemp) * exp(-
m_coeff * x);
            fprintf("The temperature of the rod x(m) from the heat source
is %.0f K\n", tempX);
        end
minRodLength = x;
end

% print the final result of the output
fprintf("\nThe minimum rod length is %.2f m\n\n", minRodLength);

The temperature of the rod x(m) from the heat source is 335 K
The temperature of the rod x(m) from the heat source is 316 K
The temperature of the rod x(m) from the heat source is 307 K
The temperature of the rod x(m) from the heat source is 302 K
The temperature of the rod x(m) from the heat source is 300 K
The temperature of the rod x(m) from the heat source is 299 K
The temperature of the rod x(m) from the heat source is 299 K
The temperature of the rod x(m) from the heat source is 298 K

The minimum rod length is 0.08 m

```

COMMAND WINDOW OUTPUT

```

%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
% for aluminum
% AlConductivity = 205;
% thermalConductivity = AlConductivity;
% rodDiameter = 0.005; %the diameter of the rods (m)
% sourceTemp = 373;    %the source temperature (K)
% ambientTemp = 298;   %the ambient temperature (K)
% PS08_fin_length_koike(rodDiameter, thermalConductivity, sourceTemp,
    ambientTemp)
% The temperature of the rod x(m) from the heat source is 360 K
% The temperature of the rod x(m) from the heat source is 349 K
% The temperature of the rod x(m) from the heat source is 339 K
% The temperature of the rod x(m) from the heat source is 332 K
% The temperature of the rod x(m) from the heat source is 326 K
% The temperature of the rod x(m) from the heat source is 321 K
% The temperature of the rod x(m) from the heat source is 317 K
% The temperature of the rod x(m) from the heat source is 313 K
% The temperature of the rod x(m) from the heat source is 311 K
% The temperature of the rod x(m) from the heat source is 308 K
% The temperature of the rod x(m) from the heat source is 307 K
% The temperature of the rod x(m) from the heat source is 305 K
% The temperature of the rod x(m) from the heat source is 304 K
% The temperature of the rod x(m) from the heat source is 303 K
% The temperature of the rod x(m) from the heat source is 302 K

```

```

% The temperature of the rod x(m) from the heat source is 301 K
% The temperature of the rod x(m) from the heat source is 301 K
% The temperature of the rod x(m) from the heat source is 300 K
% The temperature of the rod x(m) from the heat source is 300 K
% The temperature of the rod x(m) from the heat source is 299 K
% The temperature of the rod x(m) from the heat source is 299 K
% The temperature of the rod x(m) from the heat source is 299 K
% The temperature of the rod x(m) from the heat source is 299 K
% The temperature of the rod x(m) from the heat source is 299 K
% The temperature of the rod x(m) from the heat source is 299 K
% The temperature of the rod x(m) from the heat source is 298 K
%
% The minimum rod length is 0.26 m
%
% I am submitting code that is my own original work. I have not used
% source code, either modified or unmodified, obtained from any
% unauthorized source. Neither have I provided access to my code to
any
% peer or unauthorized source. Signed,
% <Tomoki Koike>
%
% ans =
%
%      0.2600

%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
%%
% for copper
% CuConductivity = 400;
% thermalConductivity = CuConductivity;
% rodDiameter = 0.005; %the diameter of the rods (m)
% sourceTemp = 373;    %the source temperature (K)
% ambientTemp = 298;  %the ambient temperature (K)
% PS08_fin_length_koike(rodDiameter, thermalConductivity, sourceTemp,
ambientTemp)
% The temperature of the rod x(m) from the heat source is 373 K
% The temperature of the rod x(m) from the heat source is 363 K
% The temperature of the rod x(m) from the heat source is 355 K
% The temperature of the rod x(m) from the heat source is 347 K
% The temperature of the rod x(m) from the heat source is 341 K
% The temperature of the rod x(m) from the heat source is 335 K
% The temperature of the rod x(m) from the heat source is 330 K
% The temperature of the rod x(m) from the heat source is 326 K
% The temperature of the rod x(m) from the heat source is 322 K
% The temperature of the rod x(m) from the heat source is 319 K
% The temperature of the rod x(m) from the heat source is 316 K
% The temperature of the rod x(m) from the heat source is 314 K
% The temperature of the rod x(m) from the heat source is 312 K
% The temperature of the rod x(m) from the heat source is 310 K
% The temperature of the rod x(m) from the heat source is 308 K
% The temperature of the rod x(m) from the heat source is 307 K
% The temperature of the rod x(m) from the heat source is 306 K
% The temperature of the rod x(m) from the heat source is 305 K
% The temperature of the rod x(m) from the heat source is 304 K

```

```

% The temperature of the rod x(m) from the heat source is 303 K
% The temperature of the rod x(m) from the heat source is 302 K
% The temperature of the rod x(m) from the heat source is 302 K
% The temperature of the rod x(m) from the heat source is 301 K
% The temperature of the rod x(m) from the heat source is 301 K
% The temperature of the rod x(m) from the heat source is 301 K
% The temperature of the rod x(m) from the heat source is 300 K
% The temperature of the rod x(m) from the heat source is 300 K
% The temperature of the rod x(m) from the heat source is 300 K
% The temperature of the rod x(m) from the heat source is 299 K
% The temperature of the rod x(m) from the heat source is 299 K
% The temperature of the rod x(m) from the heat source is 299 K
% The temperature of the rod x(m) from the heat source is 299 K
% The temperature of the rod x(m) from the heat source is 299 K
% The temperature of the rod x(m) from the heat source is 299 K
% The temperature of the rod x(m) from the heat source is 299 K
% The temperature of the rod x(m) from the heat source is 298 K
%
% The minimum rod length is 0.36 m
%
% I am submitting code that is my own original work. I have not used
% source code, either modified or unmodified, obtained from any
% unauthorized source. Neither have I provided access to my code to
any
% peer or unauthorized source. Signed,
% <Tomoki Koike>
%
% ans =
%
%      0.3600

%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
% for stainless steel
% stainlessSteelConductivity = 16;
% thermalConductivity = stainlessSteelConductivity;
% rodDiameter = 0.005; %the diameter of the rods (m)
% sourceTemp = 373;    %the source temperature (K)
% ambientTemp = 298;   %the ambient temperature (K)
% PS08_fin_length_koike(rodDiameter, thermalConductivity, sourceTemp,
ambientTemp)
% The temperature of the rod x(m) from the heat source is 373 K
% The temperature of the rod x(m) from the heat source is 335 K
% The temperature of the rod x(m) from the heat source is 316 K
% The temperature of the rod x(m) from the heat source is 307 K
% The temperature of the rod x(m) from the heat source is 302 K
% The temperature of the rod x(m) from the heat source is 300 K
% The temperature of the rod x(m) from the heat source is 299 K
% The temperature of the rod x(m) from the heat source is 298 K
%
% The minimum rod length is 0.08 m
%
% I am submitting code that is my own original work. I have not used
% source code, either modified or unmodified, obtained from any

```

```
% unauthorized source. Neither have I provided access to my code to
any
% peer or unauthorized source. Signed,
% <Tomoki Koike>
%
% ans =
%
%      0.0800
```

ACADEMIC INTEGRITY STATEMENT

```
% Call your academic integrity statement here
PS07_academic_integrity_koike(nameArray);
```

```
I am submitting code that is my own original work. I have not used
source code, either modified or unmodified, obtained from any
unauthorized source. Neither have I provided access to my code to any
peer or unauthorized source. Signed,
<Tomoki Koike>
```

```
ans =
```

```
      0.0800
```

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