EXAMPLES OF MATLAB APPLICATIONS

Sample Problem 1-1: Trigonometric identity

A trigonometric identity is given by:

$$cos^2\frac{x}{2} = \frac{\tan x + \sin x}{2\tan x}$$

Verify that the identity is correct by calculating each side of the equation, substituting $x = \frac{\pi}{5}$

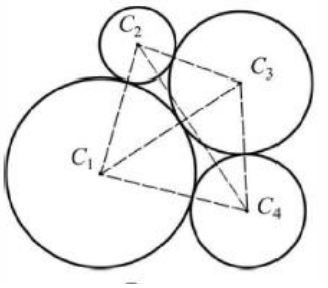
Solution

The problem is solved by typing the following commands in the Command Window.

```
>> x=pi/5 ;                          % Define x.
>> LHS=cos(x/2)^2                    % Calculate the Left-Hand Side.
LHS =
    0.9045
>>RHS=(tan(x)+sin(x))/(2*tan(x))  % Calculate the Right-Hand Side.
RHS =
    0.9045
```

Sample Problem 1-2: Geometry and trigonometry

Four circles are placed as shown in the figure. At each point where two circles are in contact, they are tangent to each other. Determine the distance between the centersC2 andC4.



The radii of the circles are:
R1 = 16mm, R2 = 6.5mm, R3 = 12 mm, and
R4 = 9.5mm.

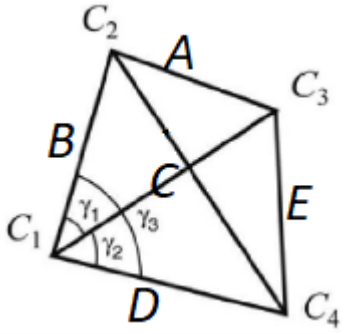
Solution

The lines that connect the centers of the circles create four triangles. In two of the triangles, ΔC1C2C3 and ΔC1C3C4, the lengths of all the sides are known. This information is used to calculate the angles γ_1 and γ_2 in these triangles by using the law of cosines. For example, γ_3 is calculated from:

$$A^2 = B^2 + C^2 - 2\,B\,C\,\cos\,\gamma_1$$

Next, the length of the side C2C4 is calculated by considering the triangle ΔC1C2C4. This is done, again, by using the law of cosines (the lengths B and D are known and the angle γ_3 is the sum of the angles γ_1 and γ_2).

The problem is solved by writing the following program in a script file:




```
% Solution of Sample Problem 1-2

% Define the R's.

Rl=l6; R2=6.5; R3=12; R4=9.5;

% Calculate the lengths of the sides.

A=R2+R3; B=Rl+R2; C=Rl+R3; D=R1+R4; E=R3+R4;

Gamma1=acos((B^2+C^2-A^2)/(2*B*C));

Gamma2=acos((C^2+D^2-E^2)/(2*C*D));

Gamma3= Gamma1+ Gamma2;

C2C4=sqrt(B^2+D^2-2*B*D*cos(Gamma3)
```

When the script file is executed, the following (the value of the variable C2C4) is displayed in the Command Window:

```
C2C4 =
   33.5051
```

Sample Problem 1-3: Heat transfer

An object with an initial temperature of T_0 that is placed at time t = 0 inside a chamber that has a constant temperature of T_3 will experience a temperature change according to the equation

$$T = T_3 + (T_0 - T_3)\, e^{-kt}$$

where T is the temperature of the object at time t , and k is a constant. A soda can at a temperature of 120° F (after being left in the car) is placed inside a refrigerator where the temperature is 38°F. Determine, to the nearest degree, the temperature of the car after three hours. Assume k=0.45. First define all of the variables and then calculate the temperature using one MATLAB command.

Solution

The problem is solved by typing the following commands in the Command Window.

```
>> Ts=38; T0=120; k=0.45; t=3;
>> T=round(Ts+(T0-Ts)*exp(-k*t))
T =                    %Round to the nearest integer.
59
```