Use generalized coordinates {q} and joint constraints {} for the slider crank shown below.

 

A

B

C

G3

2

3

4

AB = R = 0.985 inch

BC = L = 4.33 inch

BG3 = 1.1 inch

G2 is at A2 (balanced crank)

G3 is on centerline of link 3

G4 is at C4 (simple piston model) x2 axis along centerline of link 2

x3 axis along centerline of link 3

2 = 1000 rpm CCW constant

x1

y1

x2

y2

x3

y3

x4

y4

B2

B3

G3

C3

C4

A2

A1

**BLUEPRINT INFORMATION**



example for B3 

1) Evaluate residuals {} for rough estimates of generalized coordinates {q} at t = 0.005 sec shown below. Comment on the relative precision of {} versus {q}. Attach hardcopy of code.

 

2) Use geometric equations to determine better estimates for {q} at time t = 0.005 sec. Then evaluate new residuals. Comment on precision of {q} and {} between parts 1) and 2). Attach hardcopy of code.

 

3) Evaluate the Jacobian  for your better estimate of {q} at t = 0.005 sec. Attach hardcopy of code.



4) Use your code to perform a Newton-Raphson position solution at t = 0.010 sec. Calculate piston position x4 and determinant of the Jacobian. Validate with geometric equations. Attach hardcopy of code.

x4 (Newton-Raphson) \_\_\_\_\_\_\_\_\_\_\_\_  \_\_\_\_\_\_\_\_\_\_\_\_

x4 (geometric) \_\_\_\_\_\_\_\_\_\_\_\_

5) Compute piston velocity  and acceleration  at t = 0.010 sec using a matrix solution with right-hand-side (RHS) vectors  and . Validate with geometric equations. Attach hardcopy of code.

 (matrix) \_\_\_\_\_\_\_\_\_\_\_\_  (matrix) \_\_\_\_\_\_\_\_\_\_\_\_

 (geometric) \_\_\_\_\_\_\_\_\_\_\_\_  (geometric) \_\_\_\_\_\_\_\_\_\_\_\_

**EXTRA CREDIT**

Place a loop around your solution for part 5) using 0 ≤ t ≤ 0.06 sec and provide MATLAB graphs for piston position , velocity  and acceleration  as functions of crank angle . Validate using results from geometric equations on the same MATLAB graphs.

**EXTRA EXTRA CREDIT**

Modify your slider crank code for part 5) to analyze the four bar in Notes\_04\_05. This should only require modifying the last three rows in your constraint vector, your Jacobian matrix and your acceleration RHS vector.

use  = 65°  = 10 rad/sec CW  = 2 rad/sec2 CCW

validation  = 13.151°  = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ = +7.0627 rad/sec2

 = -65.173° = -5.3533 rad/sec = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_