**Two-Dimensional Coordinate Transformations**

y2’

P

d

x2’

c



y1

O2

b

a

x1











 are unit vectors





[A] matrices are orthonormal [A] -1 = [A] T

● all columns are unit vectors

● all columns are mutually orthogonal

● all rows are unit vectors

● all rows are mutually orthogonal

● det( [A] ) = +1

Provide numerical values for the three coordinate transformations shown below.

P

x4’

y4’

y7’

**Body 4**

45 deg

x7’

y1

**Body 7**

15 deg

**Ground**

x1

**units = cm**

~ -2.8 cm

~ +5 cm

1.4142 cm

1.4142 cm





- S(45°)

C(45°)

C(45°)

S(45°)

3 cm

4 cm

4 = +45°





- S(15°)

C(15°)

C(15°)

S(15°)

7 cm

2 cm



7 = +15°

 attitude angle for body j with respect to body i 

 attitude matrix for body j with respect to body i



- S(-30°)

C(-30°)

C(-30°)

S(-30°)

47 = -30°



check using MATLAB



% n0402.m - check Notes\_04\_02

% HJSIII, 14.02.03

clear

% constants

d2r = pi / 180;

% body 4

r4 = [ 3 4 ]';

s4pP=[ 1.4142 1.4142 ]';

phi4 = 45 \* d2r;

A4 = [ cos(phi4) -sin(phi4) ;

 sin(phi4) cos(phi4) ];

r4P = r4 + A4 \*s4pP

% body 7

r7 = [ 7 2 ]';

s7pP=[ -2.8 5 ]';

phi7 = 15 \* d2r;

A7 = [ cos(phi7) -sin(phi7) ;

 sin(phi7) cos(phi7) ];

r7P = r7 + A7 \*s7pP

% relative attitude

A47 = A4' \* A7

% bottom of n0402

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>> n0402

r4P =

 3.0000

 6.0000

r7P =

 3.0013

 6.1049

A47 =

 0.8660 0.5000

 -0.5000 0.8660